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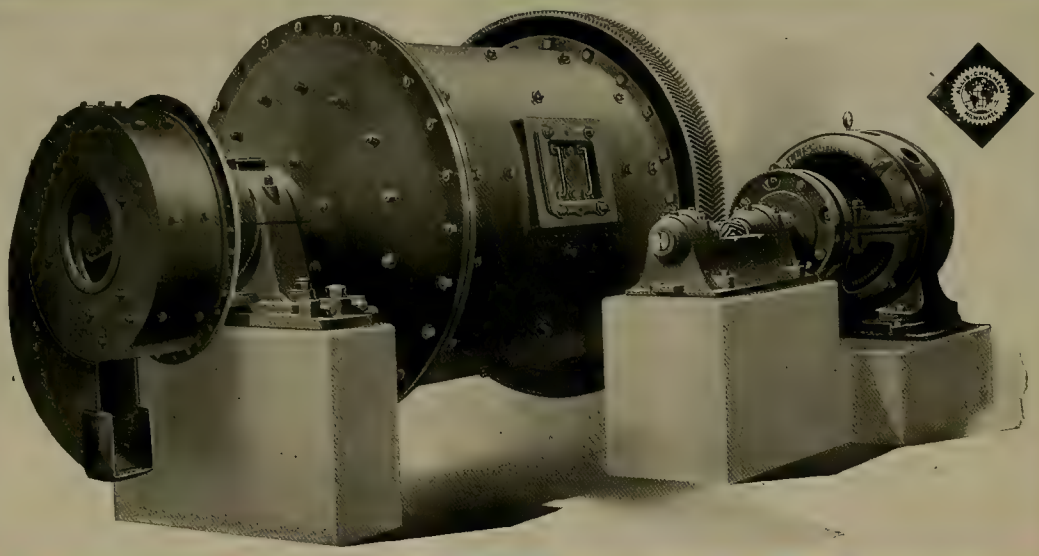

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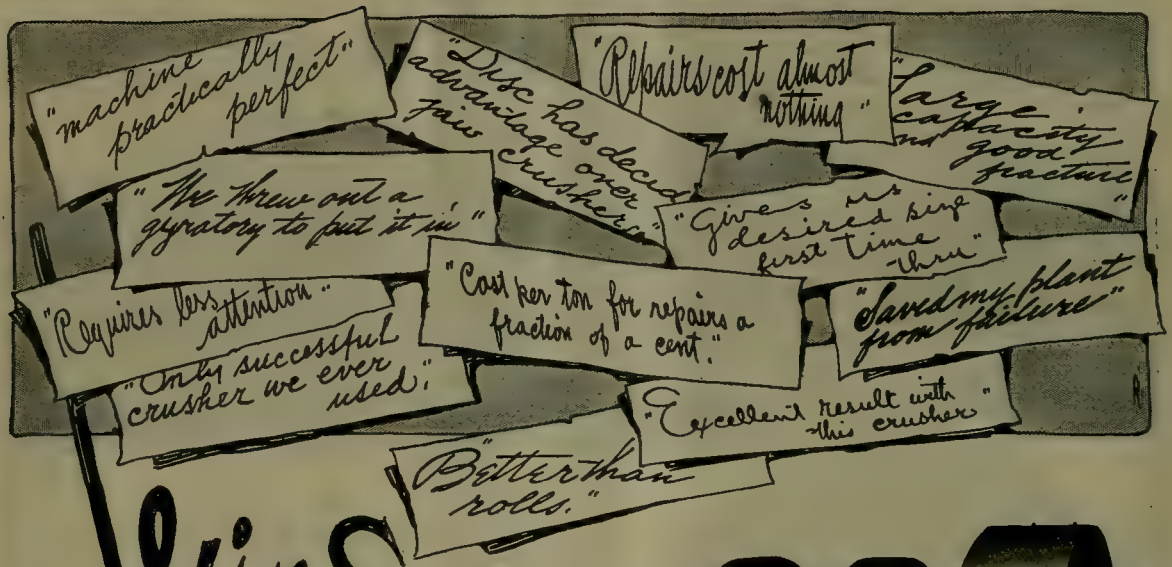
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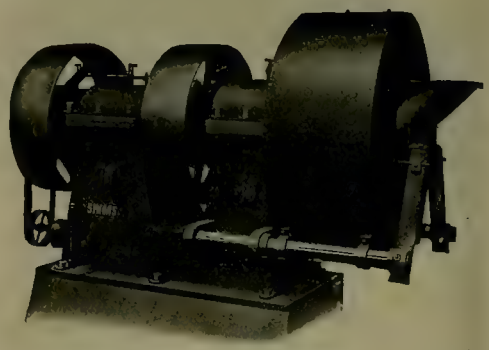

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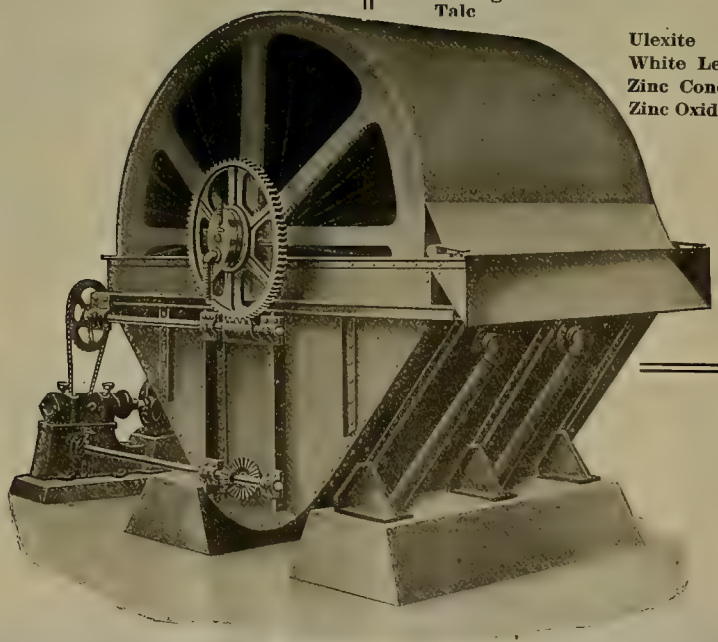


To Users of the Callow Pneumatic Flotation Cell—

The recent decision in the Butte & Superior suit with Minerals Separation has an important bearing upon the use of the Pneumatic, or Callow method of flotation.

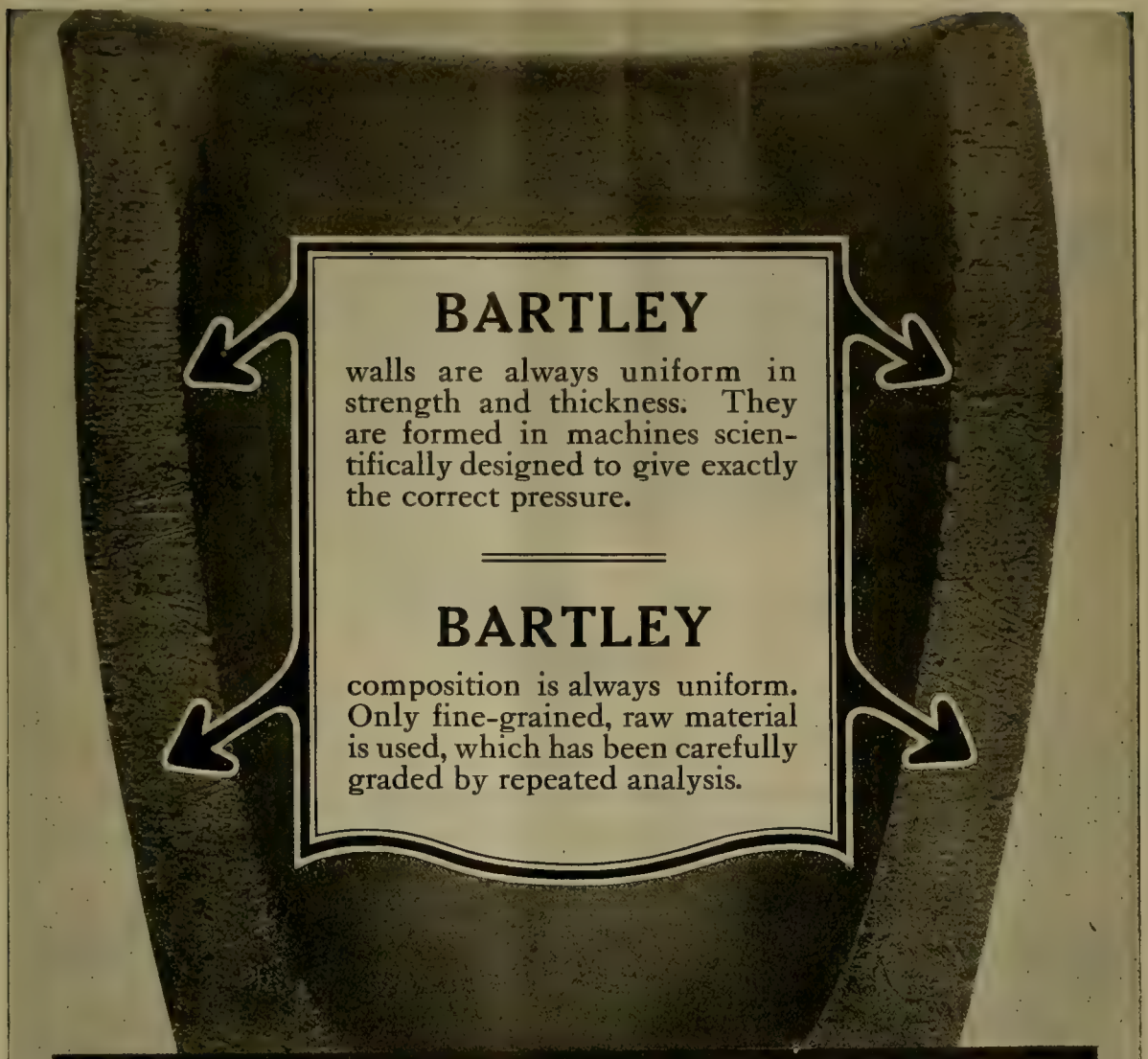
The Appellate Court's decision at Philadelphia, in the Miami case, had already made clear the distinction between (1) froth produced by violent mechanical agitation of the Minerals Separation process, and (2) simple levitation by air bubbles, as practiced in the Callow or Pneumatic cell, without such agitation.

Now the Appellate Court at San Francisco has interpreted the United States Supreme Court's opinion in the Hyde case, whereby the Minerals Separation patent was restricted to the use of a minimum, or 'critical' proportion of oil, in combination with violent mechanical agitation.

This latest decision of the Appellate Court in the Butte & Superior case, restricts the Minerals Separation basic patent to the use of a quantity of oil ***not in excess of ten pounds (0.5%) per ton of ore, in combination with violent agitation;*** it is a logical sequel to the Supreme Court's opinion and confirms the status of the Callow or Pneumatic method of flotation as distinct from the agitation-froth process.

Both the use (1) of oil in excess of ten pounds (0.5%) in combination with violent agitation, and (2) the use of the Callow system of aeration with any quantity of oil, appear therefore to be immune from any charge of infringement.

(Signed) J. M. CALLOW


BARTLEY
walls are always uniform in strength and thickness. They are formed in machines scientifically designed to give exactly the correct pressure.
BARTLEY
composition is always uniform. Only fine-grained, raw material is used, which has been carefully graded by repeated analysis.

Bartley Crucibles

From raw material to finished product Bartley Crucibles represent painstaking effort and critical inspection. These crucibles will give better results and last longer on your work. Proof will cheerfully be furnished.

WRITE FOR FURTHER INFORMATION

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OXFORD STREET, TRENTON, N. J.

Pacific Coast Representative:

Merrill Metallurgical Company

125 Second Street San Francisco

Repeat orders are coming in for

AMERICAN CONTINUOUS VACUUM FILTERS

Actual operation in many plants has proven that this filter has many decided points of superiority over other filters.

Send for our Bulletin Number 102

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CORPORATON

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RED CHIEF MINING COMPANY
CAPITAL STOCK $500,000.00

Casa Grande, Arizona April 29th, 1918

Young & Tyler,
Los Angeles, Cal.

Gentlemen:-

We are pleased to advise you the result of our first large test run of galena ore, which was as follows:

	Lead	Silver	Gold
Heads	4.6%	1 oz.	Trace
Concentrates	21.5	3 "	.80
Deduster	3.0	1 "	Trace
#1 Tailings	.5	Trace	"
#2 "	.5	½ oz.	"
#3 "	.75	1½ "	"

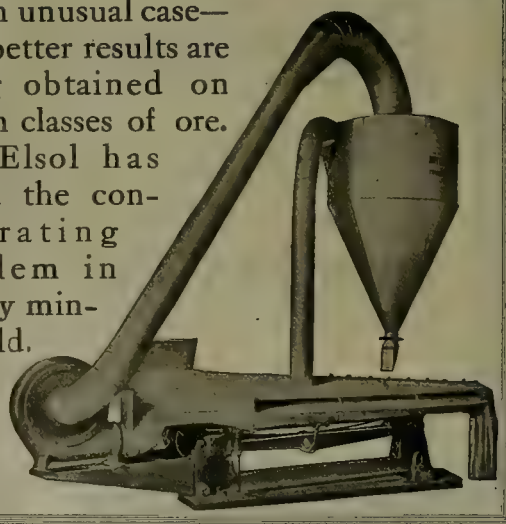
This shows a saving of about 90% on first run product which we consider remarkable for our class of ore. Our heads were lower than expected owing to the fact that a portion of the ore had been screened and the screenings covered up so that they could not be gotten at. The screenings ran 14% lead, 8 ounces silver and $3.00 gold.

Wishing you all the success that you deserve in making it possible for us to handle low grade ore in a dry country, we ask to remain,

Yours very truly,
RED CHIEF MINING COMPANY.
By J. P. Copeming
Gen. Mgr.
TPC

90% Saving
——With the——
Elsol Dry Concentrator

Not an unusual case—even better results are being obtained on certain classes of ore. The Elsol has solved the concentrating problem in the dry mining field.

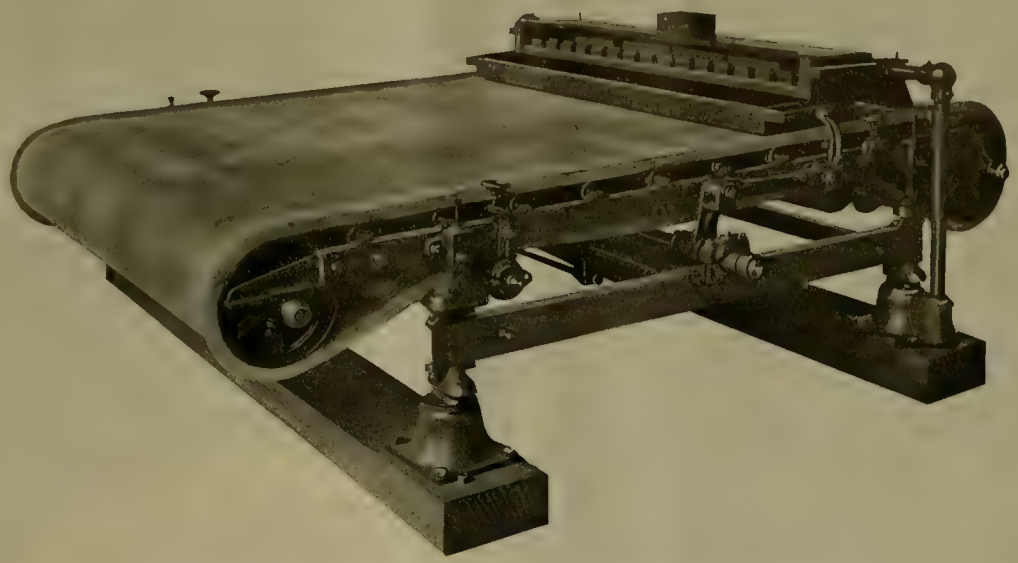


Let us tell you more about the Elsol

Write for Our Catalogue

Young & TYLER
430 Wesley Roberts Bldg. Los Angeles, Cal.

1918 Model, Simplified, Ball Bearing
Senn Panning-Motion Concentrator



Capacity;—from 20 Tons of Slimes to 150 Tons of –3 mm. Unclassified Feed, or the Entire Product of 10 Stamps.
Water Required;—2 Tons per ton of solids in the pulp.
Power Required;—3/4 Horse Power.
Shipping Weight;—Domestic, 2700 pounds; Export, 2900 pounds.
Heaviest Box;—Standard Packing, 475 pounds; Special Packing, 300 pounds maximum, if specified with order.
Floor Space;—8 feet 6 inches wide, 9 feet 6 inches long, 3 feet 1 inch high from top foundations to top feed box.

Senn Panning-Motion Concentrators Make Concentration Cheaper

When handling the usual vanner feed or a slime feed, One Senn handles the same load that would require from 4 to 6 vanners of any other make, and it recovers more of the fine or slime values than any other belt machine because its continuous "panning" motion keeps the pulp loose and enables it to handle a much thicker pulp and avoid currents of water that wash away the finest concentrates.

The Price of One Senn is only a fraction of the price of from 4 to 6 "vanners" of any other make, and the Cost of Attendance and Upkeep are Correspondingly Less Per Ton treated.

When handling an Unclassified Feed that would otherwise require "tables", the Senn still handles a thick pulp and it saves the fine values that no "table" can save. Its Capacity is equal to that of the best "table" handling the same material. It is Cheaper because its Recovery is Greater.

One Senn is handling the entire product of 10 stamps, or their equivalent, in each of a number of California gold mills; 4 Senns are handling from 150 to 200 tons per 24 hours of –80 mesh silver-gold ore in a Nevada mill; 30 Senns are handling the entire Flotation Tails from a 1400 ton copper mill in New Mexico, and 6 Senns have been installed to take the Flotation Tails from another 300 ton mill; in a mill in Canada, Senns are "roughing" the 3 mm. unclassified feed and finishing the Flotation Tails. Senns have been and are being installed from New Brunswick to New Zealand, to handle gold, silver, copper, lead, zinc, tungsten, chrome, wulfenite, etc. They are called upon to handle all sorts of materials upon which others have failed—and they do it.

"Handling" a certain tonnage, when applied to the Senn, means Making The Maximum Recovery from that tonnage, in Clean Commercial Concentrates; not merely the passing of that tonnage over the machine nor making a concentrate so dirty and low grade that it must be cleaned before it can be considered a commercial product.

The Millman "Pans" His Tailings to Check the Work of His Concentrators

The Senn Will Save All The "Pan" Can Save

Senn Concentrator Company

1215 P, First National Bank Building, San Francisco, Cal., U. S. A.

POWER & MINING

Crushing and Grinding Equipment

SUPERIOR McCULLY Gyratory Crusher

SUPERIOR Jaw Crusher

GARFIELD Crushing Roll

Get the Facts

about these record making machines

SUPERIOR McCULLY GYRATORY CRUSHERS OUR NEW DESIGN (Patented)—The Last Word in Gyratory Crusher Construction Life, of "Eccentric and Gears" Lengthened "200%," Because All "Dust and Grit" is Absolutely Excluded and "Cut Gears" run "Quietly in Oil," Main Shaft 50% Stronger than any Gyratory of Corresponding Opening Area of Eccentric, 75% Greater than any Machine of Equal Size.

SUPERIOR JAW CRUSHERS—We were the Pioneer Builders of Large Jaw Crushers—Have More Large Machines in Operation than all other Manufacturer Combined—Repeat Orders for 84 x 60-in. Machines from Chile Copper Co.; Chino Copper Co.; Hardaway Co.; Luossavaara Kurunavaara Aktiebolag.

GARFIELD CRUSHING ROLLS—Manufactured in a wide range of sizes, to meet the requirements of discriminating engineers, who demand an exceptionally efficient and worthy design. Most sizes of Garfield Rolls so constructed as to permit the use of *oversize* roll shells. A wide range of standard designs, and also several special types equipped with heavy, fly-wheel type pulleys.

(Send for the Bulletins, They're Free.)

WORTHINGTON PUMP AND MACHINERY CORPORATION

115 Broadway, New York
Power and Mining Works,
Cudahy, Wis.

M468.8

HAUL
Your Light Loads
The "Little Tugger" Way

Man or mule power will do your hauling—but the cost will be lessened by substituting "Little Tugger."

With it a single workman can haul one, two or three cars up an incline or as conveniently lower them. You save the cost of keeping a mule or the time of other workmen.

"Little Tugger" operating costs are negligible.

You can clamp or bolt it anywhere and use it for any of the odd jobs of hoisting and handling. It will lift weights up to 1000 lb. or haul much greater loads. It is portable, entirely self-contained and can be operated by anyone.

Bulletin 4233 gives full details.

Ask for a copy

39-L H

INGERSOLL-RAND COMPANY

11 Broadway, New York 165 Q. Victoria St., London

For Canada, address Canadian Ingersoll-Rand Co., Montreal

Offices the World Over

The Monotony of Unusual Performance

DUPLEX 4-WHEEL DRIVE

11th YEAR

TO DUPLEX 4-Wheel Drive Trucks, the unusual is the commonplace! Breaking records has become a matter of course.

To us, Duplex performance is nothing to wonder at; it is expected—planned, and pre-determined. This is why we rarely cite definite cases of Duplex achievement, such as the following:

Between Edgewater and Paterson, N. J., is the famous—or infamous—Fort Lee hill. It's a mile long and has grades up to 17 per cent. Doesn't sound difficult to negotiate?

No! But the bottom abounds in deep chuck holes; the middle is a mass of soft asphalt; the top section is rough cobble stones. As good measure there's a hair pin turn on the last lap.

Still, it's **negotiable**—for an automobile or a lightly loaded truck. But the Duplex was neither!

At Edgewater they gave the Duplex eight thousand pounds of sugar to **carry**—and another six thousand (loaded on a trailer) to **haul.** All told, the load totaled **seven tons.**

Summarized, the conditions were:

A stiff grade; bad road surface; difficult turn where the grade was steepest; seven tons on truck and trailer; new, stiff engine.

The 3½-ton Duplex made it!

Made it in twelve minutes. Made it without difficulty, although in places the soft asphalt was two inches deep.

Then it completed its 50-mile run on a total gasoline consumption of seven gallons, and at a cost of four cents per ton mile.

* * * *

To us this performance is not particularly startling; to us such accomplishment is perfectly natural. But here are quotations from truck **users**—who keep careful tab on all trucks.

"Seven miles to the gallon with four tons on truck, and pulling a trailer carrying three tons is indeed a marvelous performance."

"It does not seem possible that any truck . . . . could obtain such remarkable mileage."

"In all my records which cover the operation of 1400 different trucks I can find nothing to compare with it."

* * * *

The Fort Lee hill performance was unusual as a **motor truck** achievement, and **not** unusual as a Duplex accomplishment, simply because such ability is built into every Duplex truck. Exclusive principles — correct designing — careful construction — and ten years spent in doing it—help us produce a truck that is so dependable.

Duplex Truck Co., 2038 Washington Ave., Lansing, Mich.

NORDBERG HOISTS

FOR years Nordberg Hoists have been the first choice of mining experts. The largest hoist in the world—with a rope pull of 42,000 pounds, and a hoisting speed of 6,000 feet per minute—was built by Nordberg.

The hoists that hold the record for operating efficiency are Nordberg hoists. We have built hoists for almost every conceivable condition of load, depth, speed and driving power.

NORDBERG HOISTS

will enable you to hang up new records for daily, weekly and monthly production. Their use effects many unexpected economies in mine operation.

Write today for full particulars of the Nordberg Hoist. You will never invest a three-cent stamp to better advantage.

NORDBERG MFG. CO.
Milwaukee, Wisconsin

Manufacturers of High Efficiency Corliss Engines —Uniflow Engines—Popper Valve Engines— Oil Engines—Nordberg-Carels Diesel Type Engines — Blowing Engines — Hoisting Engines — Pumping Engines — Air Compressors and Other Machinery.

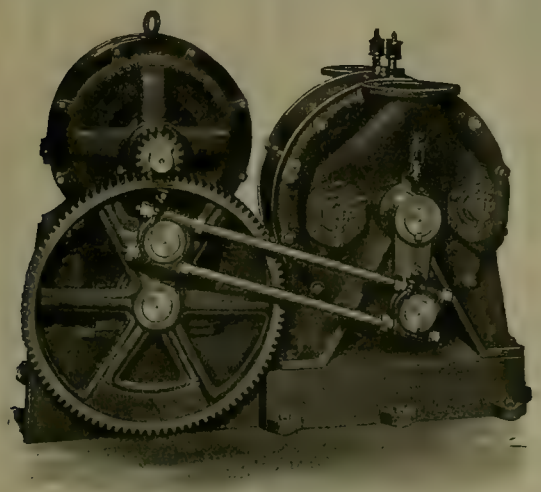
THE JACKSON COMPRESSOR COMPANY

INCORPORATED

FACTORY AND OFFICES; CHEROKEE ST., ALAMEDA TO CEDAR AVES.
DENVER, COLORADO

SOMETHING NEW IN COMPRESSORS AND BLOWING ENGINES

BUILT ALONG VERY DIFFERENT LINES THAN HERETOFORE ATTEMPTED, A BIG SAVING IN FLOOR SPACE AND WEIGHT, BUILT FOR SERVICE THAT WILL SATISFY THE MOST EXACTING.



OSCILLATING BLOWING ENGINE

Capacity 1000 cubic feet per minute at 10 lbs. pressure. Water cooled. Height 47 in. Floor space 32x72 in. Weight 6000 lbs. including motor.

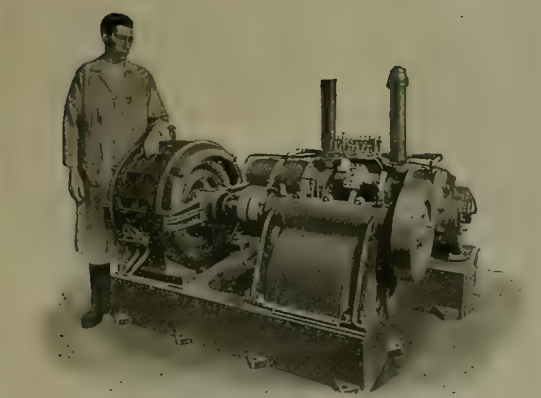
F. O. B. Denver $2,500.00.

OSCILLATING COMPRESSOR

Capacity 100 cubic feet per minute at 50 lbs. pressure. Water cooled. Height 31 in. Floor space 35x41 in. Weight complete with 4-cylinder gasoline engine 1700 lbs.

F. O. B. Denver $650.00.

Same Compressor, belt driven, up to 50 lbs. pressure, $500.00. Up to 100 lbs. pressure, $650.00.

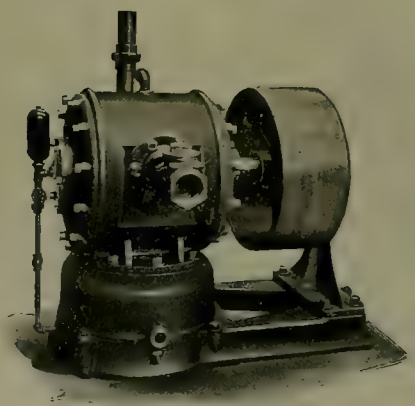


2 STAGE, MOTOR DRIVEN, OSCILLATING COMPRESSOR, WATER COOLED

Capacity 400 cubic feet per minute at 100 lbs. pressure. Height 40 in. Floor space 54x80 in. Weight 10,000 lbs. complete with motor.

F. O. B. Denver $4,500.00.

Deliveries can be made on short notice.



OUR STANDARD ROTARY COMPRESSOR

Water cooled. 100 lbs. pressure. Belt drive, complete with pulley and outboard bearing. Speed 350 R. P. M. Capacity 150 cubic feet, free air per minute. Length 42 in., width 24 in., height 30 in.

Weight about 1300 lbs. Price $1,050.00

Write us for full description and prices on other sizes.

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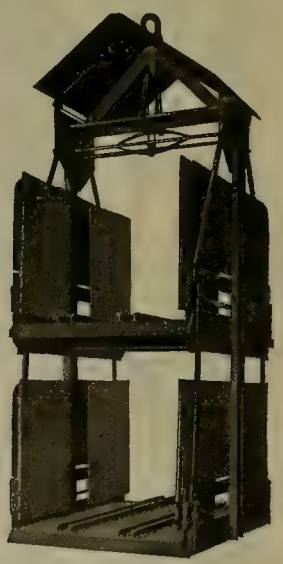
Our shops are equipped for manufacturing mining equipment of special design to efficiently meet your requirements.

SELF-DUMPING SKIP
FOR USE IN VERTICAL SHAFT

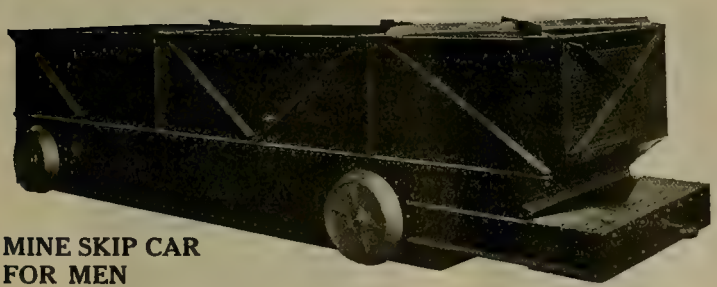
Our warehouses are headquarters for everything used in and about a mine: Hoists, Hoisting Rope, Mine Cages, Landing Chairs, Ore Buckets, Ore Cars, Skips for vertical and incline shafts, Sheaves, Safety Hooks, Pumps, Compressors, Engines, Boilers. Mining Supplies of every description. Large stocks carried at Denver, Salt Lake and El Paso.

Marcy Ball Mills Wilfley Concentrating Tables
Assay and Laboratory Equipment
Electrical Apparatus

Send us your inquiries and orders.



DOUBLE-DECK MINE CAGE



MINE SKIP CAR FOR MEN

The Mine and Smelter Supply Company

A Service Station Within Reach of You

DENVER SALT LAKE CITY EL PASO

New York Office: 42 Broadway

DU PONT AMERICAN INDUSTRIES

The Universal
DYNAMITE

DU PONT

RED CROSS
EXTRA

The All-the-Year-'Round Explosive for Ore-Mining

Ore Mining is conducted on high-production, economic and "safety-first" principles when Red Cross Extra of required strength is loaded and detonated with electric blasting caps.

Red Cross Extra is made in strengths of 20 to 60%,—a range sufficient to meet the requirements of ore-mining. Don't overlook its low-freezing property,—a big factor in open work

Tell us what are your blasting troubles. Let's help you cut your cost per ton and speed-up production.

E. I. du Pont de Nemours & Co.
POWDER MAKERS SINCE 1802
Wilmington, Delaware

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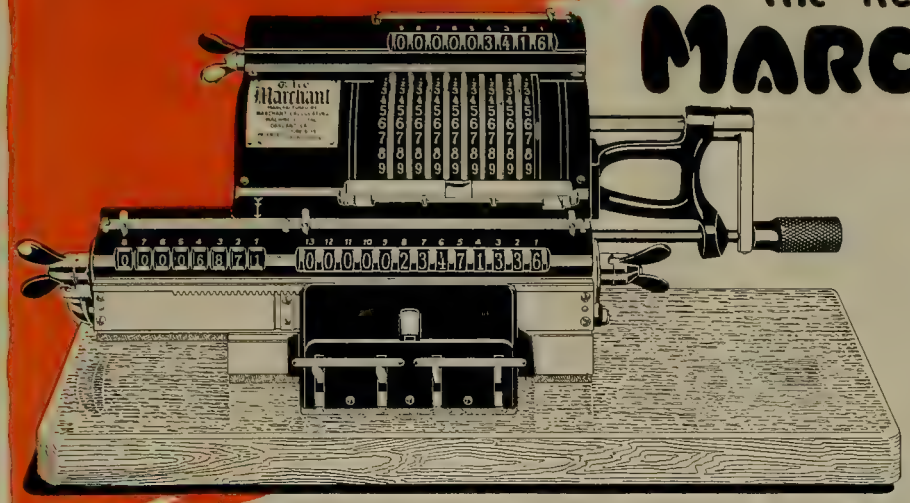
A Perfected Calculator - the new MARCHANT

Pony Special "A"



Hand figuring is obsolete—you do not permit out-of-date methods in the mine or mill. Why allow **time wasting** pencil calculation in the office?

The **MARCHANT** Pony Special "A" meets the need for a convenient calculator which may be easily carried by the mining engineer and others whose work often requires a portable instrument.

It possesses all of the features of speed, accuracy, and simplicity of operation which have made the Standard **MARCHANT** a general favorite.

It may be easily carried—weights but twelve pounds—measures eight by twelve inches at the base. It is **absolutely accurate**—all work is **automatically proved.**

The Top Register Dial a distinct new feature

gives a **double check** on every calculation. The figures placed on the setting levers are registered on the top dial also—every step is visible to the operator.

Investigate this new **MARCHANT** Pony Special "A." Mines, mills, and smelters have found it invaluable. Tonnages, averages, percentages, and costs figured easily, quickly, and accurately.

Test the MARCHANT in your own office
Let us prove its worth on your own work
Send the coupon today

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MAIL

Marchant Calculating Machine Co.
Dept. P
Emeryville, Oakland, Cal.
Drexel Bldg., Philadelphia, Pa.

Please send complete information on the Marchant Calculator

Name .....

Company .....

Address .....

Marchant Calculating Machine Co.

Emeryville, Oakland, California

Eastern Sales Office: **Drexel Bldg., Philadelphia**

Cochise Drills

—in the daily grind of actual service

Day in and day out under all sorts of conditions, COCHISE DRILLS are cutting drilling costs to a minimum.
Economical air consumption—great power and long life are the outstanding features of COCHISE DRILLS. A miner who has run a COCHISE will give it preference over any other type.

Size for size COCHISE ROCK HAMMERS have other drills beaten for effectiveness and economy.

They will drill greater footage—use less air and stay underground longer than other types.

Our claim to much greater footage at less air consumption is not idle talk.

We are ready to prove this to your own satisfaction.

COCHISE DRILLS must make money before you pay any out.

Arrange with us for a free demonstration on your own property
Write today for descriptive bulletins

Cochise Machine Co.,

Los Angeles **California**

The new home of the Cochise Machine Company—a result of the demand for Cochise products. Every detail of the manufacture of Cochise Drills is the work of experts.

make good

The Cochise
Rock Hammer

The Cochise Line Includes the Rock Hammer, Cochise Piston Drills, and Stopers

Leaders

Kennedy Gyratory Crusher — Standard Discharge

Kennedy Gearless Crusher Showing Sheave Drive and General Construction

Kennedy Crushers

KENNEDY GYRATORY CRUSHERS and **PATENTED GEARLESS CRUSHERS** lead because they are the result of a demand for a stronger and more durable crusher than has yet been put upon the market and one that would handle larger quantities of rock and ore without the attendant difficulties encountered in some of the older and somewhat antiquated types.

THE KENNEDY GYRATORY and **GEARLESS FINE CRUSHER** have patented ball and socket, self-aligning eccentric that can be run for years without the eccentric rebabbitted. This item alone will more than pay the interest on the crushing plant, to say nothing of the increased capacity which is the result of a constant eccentricity.

This is only one of the many important features found in the **KENNEDY CRUSHERS**. Our catalogs contain illustrations and descriptions of the latest and most modern **GYRATORY CRUSHERS**. While we have not attempted to imitate other makes, we have not departed from the settled practice in the general design of **GYRATORY CRUSHERS**; we have applied modern and up-to-date mechanical features to the principal working parts, which will be at once recognized and appreciated by the skilled operator and engineer as being vastly superior to anything that has yet been designed.

Bulletin No. 2 on the **GEARLESS FINE CRUSHER** will be very interesting to you, as it describes fully this very superior **FINE CRUSHER**. You should acquaint yourself with this new equipment; it will prove a revelation.

Collins & Webb, Inc.

Manufacturing Engineers and Machinery Dealers

412 E. Third St., **Los Angeles, Cal**

in Their Class

The Isbell Concentrator

leads, because —

It will treat a mixed pulp direct from grinding screens as coarse as 6 mesh **without preliminary classification** and save both the slime, fine and coarse concentrate.

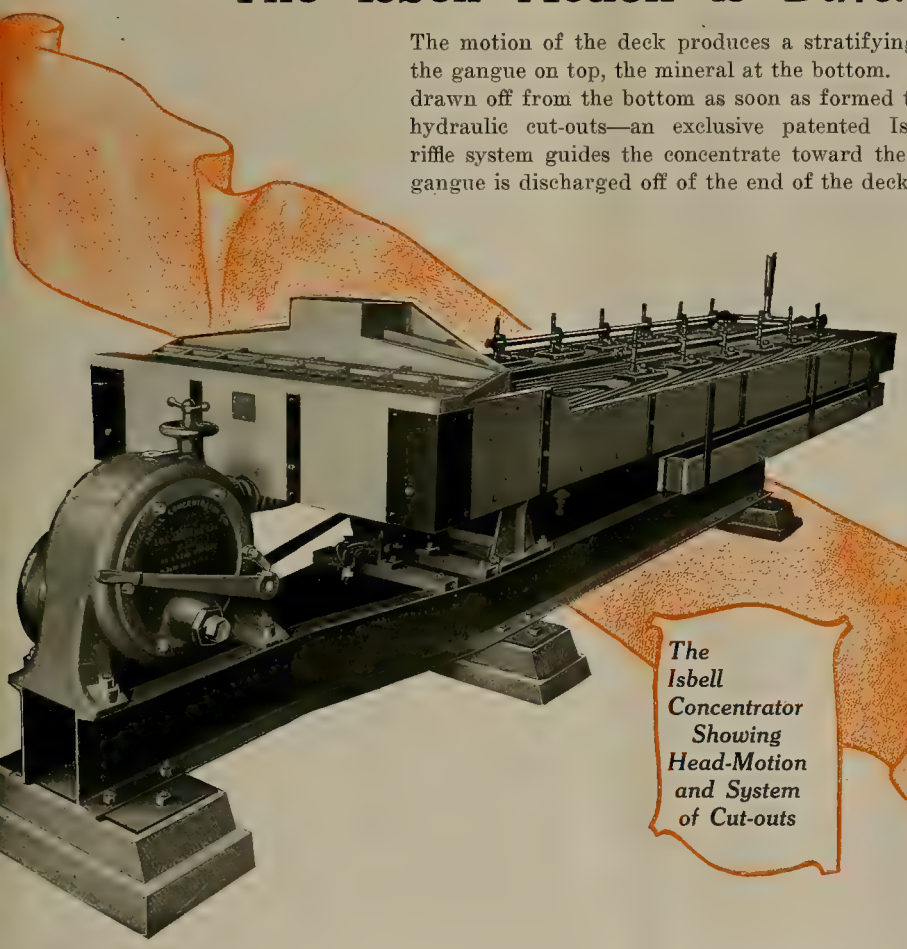
Uses absolutely no cross wash-water, therefore no loss of slime. Saves the cost of classifiers, sizers, settling tanks, vanners or "slime tables," with their necessary power and transmission, mill floor space, etc.

Has a capacity with recovery equal to the average of four of the cross wash-water type of table—treats 50 to 100 tons per 24 hours.

Most substantially constructed concentrating table ever made—the Isbell patented head motion is simplicity itself—self contained, self oiling and trouble proof.

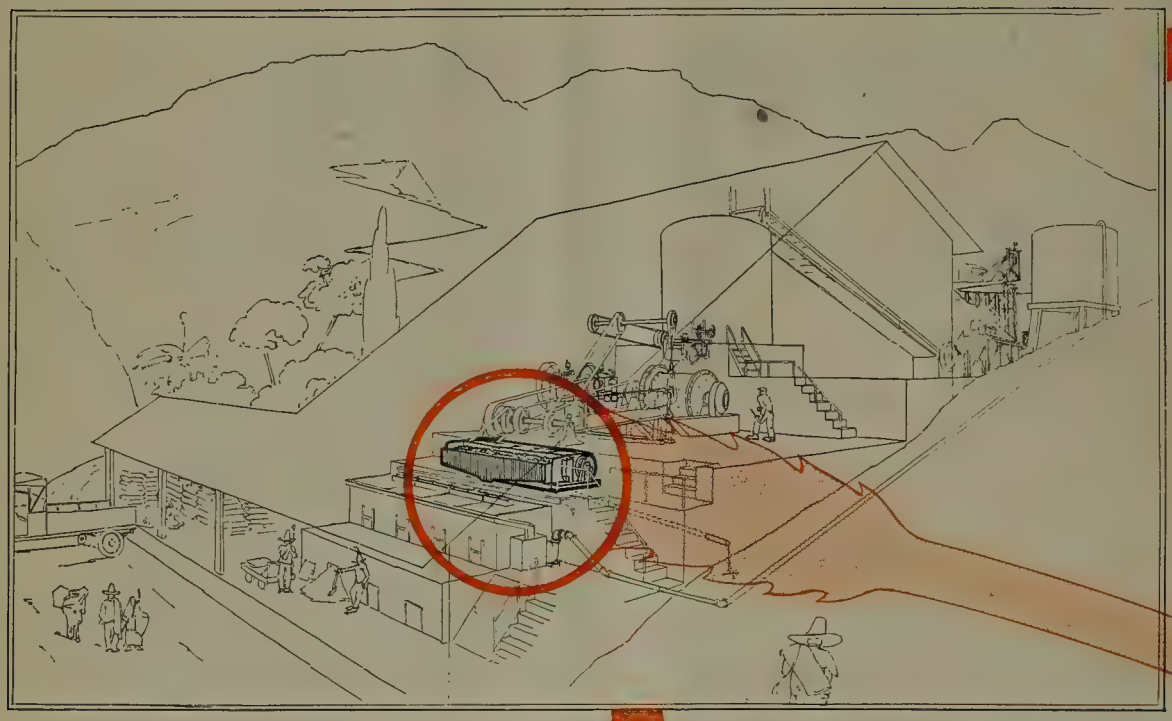
The Isbell Action is *Different*

The motion of the deck produces a stratifying action at once—the gangue on top, the mineral at the bottom. The concentrate is drawn off from the bottom as soon as formed through a series of hydraulic cut-outs—an exclusive patented Isbell feature. The riffle system guides the concentrate toward the cut-outs while the gangue is discharged off of the end of the deck, a clean tailing.



The Isbell Concentrator Showing Head-Motion and System of Cut-outs

INVESTIGATE THE ISBELL TODAY. IT OFFERS POSSIBILITIES FOUND IN NO OTHER TABLE. A BULLETIN CONTAINING VALUABLE INFORMATION WILL BE MAILED ON REQUEST. SEND FOR IT.



The K & K Flotation Machine in a typical plant. Note the compact get-at-able-ness of the entire arrangement.

Flot
Mac

One Continuous Operation

From pulp to concentrate—and no lost time. A continuous operation is afforded during which separation and discharge take place. Note the typical installation above. The feed enters at one end of the machine, the tailings being discharged at the opposite end while the concentrate is discharged over the lip of the "frothing chamber" into a suitable launder. Everything necessary to complete separation is accomplished in one operation.

If you are considering the installation of flotation equipment you cannot afford to overlook the K & K. There have been many instances where it has turned flotation from a failure to a success. Our metallurgical department had made a study of the difficulties presented by different ores which hitherto were not considered amenable to flotation. We have valuable information on the treatment of carbonate ores and have worked out many knotty problems by flotation.

Let us aid you with the information we have secured. Write today for our new and complete catalogue.

Southwestern Engineering Co.,

523-526 Wesley Roberts Bldg., Los Angeles, Cal.

A Complete Flotation Unit

ready for business the minute you set it up. Connect up with power—introduce your flotation feed and the machine does the rest. No pre-agitators, compressors or other auxiliaries required. Automatic control requiring little or no attention.

The K&K ation hine

Large Capacity

Largest machine treats 80 to 150 tons per 24 hours; smaller sizes also made. The K & K cycle of operation delivers the concentrate in the shortest possible time—therefore the high capacity.

Low Power Consumption

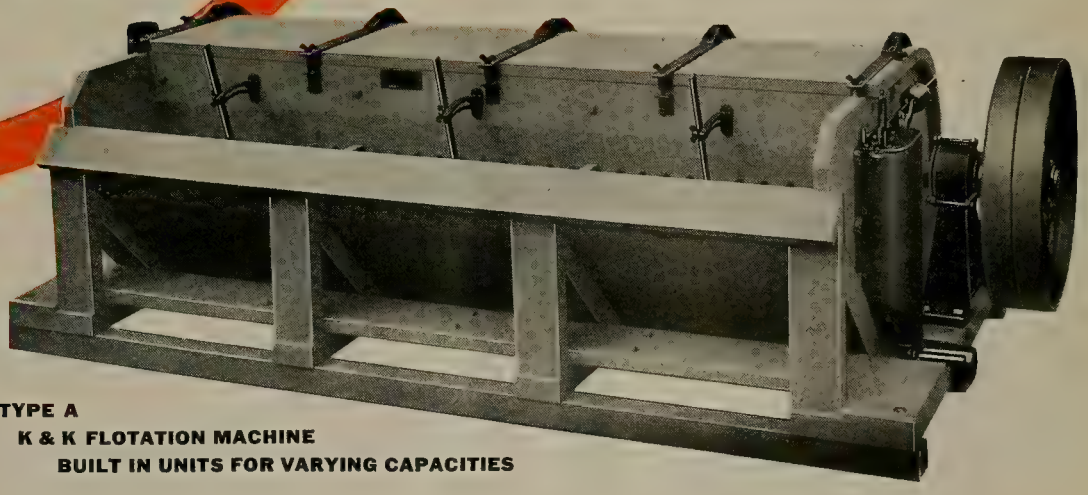
Requires but 6 to 8 H.P.—no violent churning or agitation with the K & K. The rotor is the only moving part and is mounted on ball bearings producing minimum friction losses.

Low Up-keep Expense

There is practically nothing to wear out about the K & K. The only wearing parts are the riffles which are easily and cheaply replaced.

Small Floor Space

The K & K requires about half the space for installation needed by other machines—only 4½ x 15 ft. for the largest size. Also very little head-room is needed. This has made its use possible in many cases where larger apparatus would have caused considerable expense for re-arrangement.



TYPE A
K & K FLOTATION MACHINE
BUILT IN UNITS FOR VARYING CAPACITIES

NEW PROCESS BALLS

FOR BALL MILLS AND CEMENT MILLS

Scleroscope and Physical tests show these balls to be 15 to 20% better than standard type balls now available.

Prompt delivery. Send us your order now.
Samples on request.

ECCLESTON MACHINERY COMPANY
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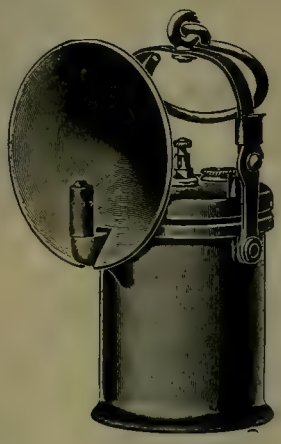

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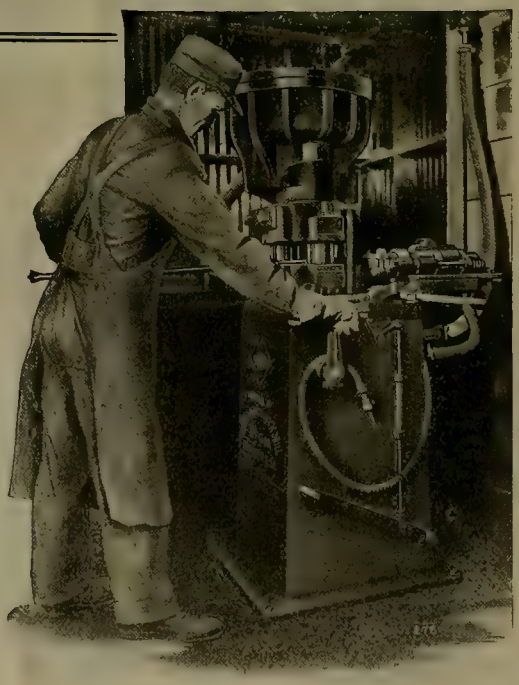

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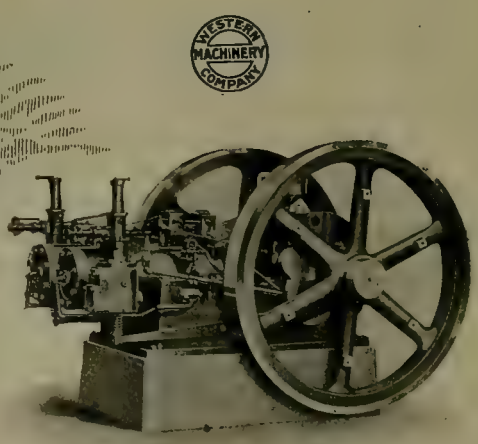

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43-43

NEVER since the Declaration of Independence has the Fourth of July been celebrated so worthily. On the 142nd anniversary the United States is making good the Declaration by fighting for its own safety and for the safety of the allied democracies against a tyranny as much worse than that of the German-English King, George III, as it is more menacing to human liberty elsewhere. This Fourth is not only a national holiday, it is an international celebration in which 23 peoples participate enthusiastically.

HOUSE Resolution No. 291, introduced by Mr. James H. Mays, of Utah, proposes to extend to oil-shale placer locations the Act suspending the requirements of annual assessment work upon mining claims for the years 1917 and 1918. The wording is not specific as to how the exemption shall apply for the past year, but an amendment will probably cure this defect before the measure becomes law.

ALUMINUM is so essential to the construction of aeroplanes that a vulnerable point in the German structure appears in the circumstance that her main dependence for bauxite is upon the mines near Sebenico and Derins in Dalmatia. Sebenico lies but a short distance from the sea. If this source of supply could be cut off the effect upon the size of the German air fleet would soon become apparent. Elsewhere in this issue we publish a statement of German methods of reducing aluminum ores.

FROM Washington we hear that the recent meeting of the Institute was an unqualified success. On the invitation of the Food Administrator the engineers dined at the Food Administration cafeteria. A number of speeches were made on patriotic effort, more particularly on the winning of metals for use in the War. Mr. Hoover himself spoke, we are informed, "most effectively." Other speakers were Messrs. Sidney J. Jennings, R. V. Norris, William L. Saunders, and Pope Yeatman. A new section of the Institute was organized.

IMPORTATION of 12,000 tons of ferro-manganese from Great Britain has been authorized by the War Trade Board to offset the shortage of ore in this country. The American Iron and Steel Institute, through its subcommittee on ferro-alloys, has recommended that the standard for ferro-manganese be reduced from the present requirements of 78 to 80% of manganese to 70%, and that spiegeleisen shall contain from 19 to 21%. It is proposed that the new standards be accepted as 'good delivery' under existing contracts, with suitable adjustment of tonnages and prices. These recommendations are made in order to conserve shipping and to encourage the utilization of domestic ores as far as possible. The importation of ferro-manganese, therefore, is only a make-shift until the supply from our own mines shall respond more fully to the needs of the steel industry.

AN interesting statement is made by Mr. G. J. Kapteyn, a Dutch engineer recently arrived in this country from Holland, that United States gold notes are in great demand in his country, whence they are smuggled into Germany. The normal money-changer's value of American currency in Holland is 2.45 florins on the dollar; the present rate is 4.85. At the same time the rate for British currency is 13.6 florins per pound sterling, as opposed to 12.1 before the War. The inference is that the Germans are playing safe, and that they entertain a strong conviction that England and America will still loom large on the map when the smoke of battle has cleared away. Nevertheless, we think that the Germans have not yet been punished as much as they deserve, otherwise the premium on our currency would be higher. At the same time we note Mr. Kapteyn's earnest plea for a generous compromise peace with the Teuton, from which it would appear that Holland is too close to Germany to admit of seeing things from the Allied point of view.

THE War-Minerals bill, as passed by the House, is now before the Mines Committee of the Senate, where it has been held in abeyance pending the return of Senator Henderson. The House struck out the principal clause, namely, that authorizing the President, through the Secretary of the Interior, to guarantee a fixed minimum price on specific minerals for a period not to exceed two years. It is expected that the Mines Committee of the Senate will restore this proviso, without which the Bill is emasculated to the point of uselessness. A decision in this matter is due at any moment, our hope being that an alternative clause, embodying the one deleted by the House, will be added, so as to give

effect to the original purpose of the Bill. Elsewhere in this issue we publish the testimony of Mr. Ingalls, whose opposition to the Bill is noteworthy. If he made out a much poorer case than Mr. Manning, who testified for the Bill, we may assume that he was handicapped by the weakness of his case.

RAFFERTY, FRANK A., Armagh, Ireland, is the first name in a recent casualty list. He was a corporal and was "killed in action," fighting in the American Army. We salute this good citizen; it is he, and others like him, that will solve the Irish problem. When Irishmen are fighting and dying for the cause of human liberty, whether they be enrolled under the American or the British flag, they are making good the claim to Home Rule, and they are shaming those that stay at home to make political trouble at a time when complete unity of effort is essential. When a man is in a fight, for a right cause, he is impatient of a friend that stays out of it, and he has no use for his friend if he fail to come to his aid, no matter what the reason—least of all politics. The Irish have a sense of humor; they will see that so long as other Irishmen are fighting in France it is absurd for their comrades to remain in Ireland talking. "Come on, boys, the water is fine!" Don't wade in the shallows of a domestic squabble, but plunge like brave swimmers into the deep waters that will wash the world free from Prussian bestiality.

AT a time so critical, when our heart-strings vibrate continually to news from the battlefields in Europe, it is a pity that the editors of our daily papers do not place the selection of head-lines in the hands of grown men—that is, mentally grown. Most of the head-lines appear to be concocted by ignorant boys. We read "Austrian Line Broken," as in truth it was two weeks ago, but the head-line we quote referred to a local skirmish. If the British make a successful raid, the 'Huns are Hurled Back"; if our American boys are successful in an affair of outposts, it is "Another U. S. Victory"; if the French advance a thousand yards on one flank, it is "Germans Crushed by the French," although concurrently the other flank may have been compelled to retire several miles. We have had some notable successes lately, especially on the Italian front, and our own Army is beginning to make itself felt in no uncertain way, but it is only childish to exaggerate every little affair in which our men or those of our Allies are successful. The daily exaggeration of bits of good news destroys the true perspective of the great events that we are witnessing through the turbid medium of newspaper correspondence. It is time for editors to appreciate the dignity of history in the making.

NO peaceful settlement of the issue between the Allies and the Enemy is possible so long as the leaders of Germany talk in terms that to us are incomprehensible. The recent speech of the Kaiser and the speeches made in the Reichstag by Von Kuehlmann and Von Hertling are couched in language that indicates methods of reasoning utterly different from the rest of the world. There is such a failure to recognize facts as we see them that these German pronouncements might as well be published in Mars as in the Allied countries. The Kaiser says that the War is due to the Anglo-Saxon ambition to dominate the world; Von Kuehlmann says that Russia is the culprit. At first England was chiefly to blame, because she did not remain quiet when the German armies used Belgium as a road to Paris; now England is only third in blame, the first place being given to Russia and the second to France. The German Secretary of Foreign Affairs says that Germany asks for "a free existence within the boundaries drawn for us by history." What historian is to decide? Treitschke? The reading of history has manifest subjective limitations. Germany desires "the freedom of the seas." Our notion of freedom is not the same as the German, and that is why we are fighting. The German idea is unrestricted submarine piracy, ours is that the seas shall be free to peaceful commerce. Germany desires "overseas possessions corresponding to her greatness and wealth." She has shown striking incapacity to administer her colonies. The vaunted greatness of Germany is being prostituted to brutal aggression and to bestial warfare; her wealth was used for insidious propaganda and the secret penetration of her neighbors; we recognize no claim for dominion based on the superiority suggested, on the contrary we hold that her actions have proved her entirely unfitted to control peoples other than her own. It is satisfactory to note a recognition of the fact that the end of the conflict "can hardly be expected through purely military decisions alone," but the blatant boast of the Kaiser and his generals has been for four years that the "good German sword" was going to settle the question. Just now it is the purpose of the Allies to prove that there are better swords than the Germans, and that free men fighting for liberty can use them not only to defend themselves but to cut through the sophistries and insincerities of the Potsdam conspirators, who now stand unmasked and unashamed before the world.

James Douglas

Edmund Garrett, the editor of the 'Cape Times,' said that two things made life worth while: friends and the hope of being effective. He achieved both, although he died at 42. A few days ago there passed James Douglas, at the age of 81, after a long life as effective in service as it was rich in friendships. Born at Quebec, the son of a physician, he became a resident of the United States in 1875. He began his career as a professor of chemistry in his native city and early became associated with Thomas Sterry Hunt in developing the hydro-metallurgy of copper, one result of which was the invention of a process that holds an honored place in the history of the art. Later he became mining engineer to the founders of the Phelps Dodge Corporation, and guided

them in the development and exploitation of copper mines in Arizona, and the South-West generally, until he became identified with some of the biggest and most successful mining enterprises in the world. His standing as an engineer was recognized by his being twice elected president of the American Institute of Mining Engineers, and by other honors, including honorary degrees from universities. Despite the preoccupations of a successful professional career, he found time to write, not only many valuable technical papers, but several pamphlets and books of a scholarly character, such as 'Old France in the New World' and 'New England and New France.' He was keenly interested in the history of America on both sides of that boundary which needs no forts to guard it; more than this, in his own person, he illustrated the solidarity of sentiment and the unity of purpose that now animates the three great democracies of the world. James Douglas was sagacious rather than smart, he was wise rather than clever, he was the James Bryce of mining; like that distinguished Scottish author and diplomat, he had a kindly humor, a keen insight into the character of men, a philosophic outlook on life, and an unfailing kindness for those less fortunate than himself. How many there must have been during the last few days that stood up to say, "He helped me when I was a young fellow," "He encouraged me in my work," "He gave me the suggestion that led to my success." Blessed are the old when they leave such a trail behind them—a trail on which the forget-me-nots grow.

When the newspapers announced his passing, one spoke of him as a "copper magnate," another as a "millionaire." How he loathed such terms! Magnates and millionaires are cheap compared with such as he. They may, like him, be magnificent in their financial benefactions, for he endowed universities and hospitals, but he gave much more, he gave the priceless gift of human sympathy, as warm as it was intelligent. He was unassuming, simple in manner, unaffected, he preferred the Mr. to the Professor or Doctor that was his by right, he was unfailingly courteous, in a way that we call old-fashioned because it has become uncommon in the rough and tumble of modern life. He was a gentleman of the old school, to whom belonged peculiarly "the grand old name of gentleman, defamed by every charlatan, and soiled by all ignoble use." As a mining engineer he held to his ideals, setting an example of the most stimulating kind during half a century of professional work. He took a strong stand on a matter vital to technical progress: he was opposed to secrecy in the arts. Twenty years ago he attacked the "mistaken reticence" that leads metallurgists to hug their experience to themselves; he contrasted "the wasteful effects of secrecy" with "the nobler practice of mutual helpfulness." True to his own preachment, he gave freely from his individual store of knowledge, to his acquaintances as to scientific societies in formal assembly. He agreed with Bacon in holding "every man a debtor to his profession, from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereto." A help and an ornament to his profession he was. These to his memory.

The Tariff Hearing on Metals

The most important result, so far, of the calamitous end of our trust in international harmony has been to reminds us of Washington's warning to be prepared. We have discovered also that a vital condition for national protection is economic self-sufficiency; we have found how perilous it is to depend upon supplies of potash from Germany, of nitrate from Chile, of chromium from New Caledonia, of antimony from China, and of manganese from Brazil, Russia, and India. With the utmost desire on the part of England, France, and Brazil to help us in this emergency, the scarcity of shipping renders their goodwill of small avail; we are forced to develop, hurriedly and inadequately, our own latent resources. The argument that flows logically from this is that we should encourage the development of every essential material at all times by a consistent use of the tariff. That was the thought lying back of the hearing conducted by the United States Tariff Commission last week in San Francisco, on which occasion the status of the antimony, quicksilver, and tungsten industries was considered. This is looking toward the future, when the fighting is over, when we may lay our plans for a better ordered economic system. The chairman of the meeting, Mr. W. S. Culbertson, called attention to the scope of the activities of the Commission, with the desire to extend its usefulness. Because a hearing is given to the representatives of some particular industry the inference must not be drawn that immediate steps will be taken to establish a duty upon the article concerned. As now constituted the Tariff Commission is purely advisory to Congress; its duties are to collect and collate data that may serve as a guide to Congressional legislation; it performs no star-chamber functions, but gathers its information openly and records it for the use of the people. The time may come, and should come, when a more scientific organization of government will result in giving to a tariff commission the duty of adjusting the tariffs themselves according to fixed rules for equalizing competition, but this transcends any conception that yet seems to have entered the minds of our law-makers. That is for a wiser and saner future, when we shall honestly and seriously endeavor to establish a benevolent peace throughout the world, instead of the cut-throat peace before the War that offered Germany an opportunity to levy unjust tribute upon all nations. Our present duty is to proceed as if altruism were a forgotten ideal, and to shelter ourselves under protective laws. To this end we must remember that the Tariff Commission is a permanent institution; that its headquarters are at Washington; and that it seeks all the information obtainable regarding every industry. Its activities are not confined to public hearings, like the one just held on the minor metals; it welcomes data that any producer may choose

to submit, by letter or otherwise, at any time. The trouble with the mining of antimony, tungsten, and to some extent with mercury, these being the metals discussed at the conference with the Commission in San Francisco, is the erratic character of the orebodies, and it was clearly shown by the evidence that a relapse to the inactivity existing before the War is inevitable unless protection be accorded. Details of the testimony on antimony were presented in our issue of last week, and a summary of the evidence on quicksilver and tungsten appears elsewhere in this number. The special problem presented by quicksilver is the treatment of low-grade ores. Unless that can be done successfully the industry will languish. Mr. L. H. Duschak has just completed a valuable study of the metallurgical methods adaptable to low-grade ores, and we hope to publish it shortly. He shows that a 90% recovery is practicable here as well as in Austria, whereas American practice today returns only about 75% of the total mercury content of the ore. Mr. H. C. Davey, of the Guadalupe mine, in California, showed that as much as 75% of the costs of production were chargeable to exploration. An increase in the percentage saved would alter that figure, but we may accept the statement of Mr. H. W. Gould, of the New Idria company, that a specific duty of $35 per flask, in addition to the existing tariff of 10% ad valorem, is essential for ensuring the industry against decline. The average grade of Californian deposits is about 0.4%, while the Spanish ores, after sorting, contain 14%, a grade unattainable in this country.

The market for antimony has always been erratic. This is not the result of sudden fluctuations in consumption so much as because any metal that normally occurs in small detached orebodies is unattractive to capital; production therefore depends upon the occasional work of men who do not find it worth while to make it their exclusive business. This has been true of tungsten as well as of antimony. The discouragements incident to uncertain and unsteady output soon cause a decrease in deliveries until the market presently reveals that the demand has distanced the supply. The price and the output thus play a game of battledore and shuttlecock. The low prices before the War nearly extinguished the antimony industry in this country, because the unstable conditions previously mentioned disheartened the American miner, so that the dependence of the world for its supplies fell upon countries where a superabundance of low-priced labor was available. There may be more antimony in China than in the United States, but coolie labor is the controlling factor. Mr. C. Solomon Jr., a smelter of antimony, declared that a duty of $10 per ton would not prevent the Chinese from shipping it hither; he advocated a bounty of 3 cents per pound to the American miner, and 5 cents to the smelter, in order to encourage domestic production. It is well to point out, however, that the chief difficulty has been the uncertainty of a sustained price at a remunerative level; therefore no response in production comparable to the rise in quotations has taken place. The same is true regarding chrome and magnesite. A tariff sufficient to stimulate initiative in producing these metals in large quantities must needs be much higher than the duty requisite for sustaining such an output once it has begun. This emphasizes the urgent need of passing the War Minerals bill with the price-fixing authority retained. The Government is now protected against loss in accumulated stocks by the Act approved by the President on May 10 of this year. That disposes of one of the arguments offered by members of the House against a guarantee. It transpired, also, at the hearing on tungsten, that the activity of firms owned and controlled by Germans has been most pernicious in bottling up many of the tungsten mines of the country, the favorite scheme being to buy promising properties and keep them idle. German concerns, under the plea of pacifism, before we entered the War, bought all the tungsten that was offered them, and refused to re-sell, except under the obligation of old contracts. This was to save the souls of Englishmen from the sin of killing Germans! Such tactics helped materially to force the price to its abnormal height. Once again the Teuton miscalculated, for when tungstic acid finally rose to more than $100 per unit the resources of the country proved to be enormously greater than had been expected. It was impossible to corner the market. After we declared war all stocks were practically commandeered, including those in German-American warehouses, but restriction of the output was then attempted through acquiring ownership of the leading sources of supply. The War Minerals bill specially provides means for destroying this kind of obstruction by the Enemy.

Large deposits both of mercury and tungsten ore exist in the United States, and a suitable guarantee for the disposal of the product at a remunerative price, coupled with continuing protection under a tariff, would lead to exploitation on a scale great enough to ensure an output that would make us independent of importations from other countries. That seemed to be the sense of those who testified at the hearing, and it indicated the double requirement of passing the emergency War Minerals bill and of adopting a sane protective policy. At the present moment, as shown by Mr. J. H. Mackenzie, we are actually accumulating stocks of tungsten, but we must be careful not to draw false conclusions from that fact. We must remember that the richer deposits, by their very nature, are precarious, and also that the larger, low-grade, and more dependable resources, with few exceptions, remain untouched. In most cases where big low-grade deposits are left unexploited the cause is the same as that which retards the production of other minor metals, namely, the capital expenditure would be so large, whereas the persistence of remunerative prices through a period of years is so uncertain, that the provision for rapid amortization thus made necessary, coupled with high taxes, render expansive ventures too perilous for careful business men to undertake. The assurance of our supply of these minor metals depends primarily on the immediate enactment of the War Minerals bill.

The Production of Quicksilver and Tungsten

As Discussed Before the United States Tariff Commission at San Francisco

On June 26 the status of quicksilver in the United States was discussed at a public conference before the U. S. Tariff Commission. W. S. Culbertson presided, and Guy C. Riddell acted as metallurgical adviser. There were more than forty present, exclusive of officials.

The following table summarizes the output and prices during the past five years:

Year	Flasks	Average price per flask
1917	36,351	$98.29
1916	29,932	93.50
1915	21,033	81.52
1914	16,548	49.05
1913	20,213	40.23

H. W. Gould of the New Idria company represented most of the Californian producers and one in Texas. He viewed the post-war outlook with some concern if the present tariff is to apply. War-prices have stimulated prospecting and development in this country, although the principal increase in production is from the old mines. America cannot compete with the higher-grade ores and cheaper labor of Austria, Italy, and Spain, in normal times. The average cost of producing mercury in the United States is between $70 and $75 per flask. The Almaden mines in Spain yield mercury from ore averaging 11%, at a cost of $16 per flask. These deposits are owned by the Spanish government, but the output is contracted to the Rothschilds in London at £7 per flask. London has been considered the controlling market. The industry in Europe has been fostered by the governments. Metallurgical methods in Austria and Italy are efficient, but not so in Spain. The ore-reserves at Almaden are good for 40 years, on the basis of an output of 1000 tons of metal per annum. The cost in Austria and Italy will always be lower than in America, and those countries will be able to dump metal in America at less than $40 per flask. The ore deposits in California are small when compared with those in Europe. The main orebody at Almaden, Spain, carries 14%, and subsidiary orebodies 2½%. The average grade in California is 0.4%, equal to 8 lb. per ton of ore. The Italian content is about 1%; in Austria 0.85%. The Scott furnace is recovering 75% of the Californian output. Production after the War is likely to be much lower than before, owing to lower grades of ore being worked, these being about half as rich as in 1914, owing to the high prices. The New Idria and the Sulphurbank mines in California concentrate 300 tons daily each, but the losses are excessive. Mr. Gould sees no economic future for these properties. Mechanical concentration yields a product containing from 3 to 50% mercury. The recovery is as low as 50%. The costs at New Idria increased from $47.50 per flask in 1914 to $68 in 1917, covering an output of 11,000 flasks per year. The reserves of ore in the United States are not considered extensive. Labor costs account for 43% of the New Idria output, wages having increased 75% in three years. When the costs in California are compared with those in Europe—$75 here as against Spanish metal imported at $40 per flask—it is comprehensible why the producers suggest a duty of $35 per flask in addition to the present 10% ad valorem tariff to maintain the present American

MAP OF THE UNITED STATES SHOWING SITUATION OF QUICKSILVER DEPOSITS

output. The current price is $105, compared with $35 to $40 prior to the War.

Edmund Jussen, of the New Almaden mines, California, stated that his company handled ore from which 6 lb. was actually recovered, against 220 lb. in Spain. The geology at New Almaden, California, is similar to that at New Idria, and the costs are $90 per flask, based on the ore actually mined. The Cottrell precipitator is used to bring down the dust prior to the condensation of the mercury. The temperature of the gas passing through the Cottrell treater is too high to admit of condensing the metal. The Senator mine, of the New Almaden company, is 600 ft. deep, the old mine 2000 ft., and the New Idria 1200 ft. on the dip of the vein. The best incentive for the industry will be an assured price.

Clifford G. Dennis considered that the efficiency of labor at the two mines he supervised in California (the St. Johns) and Nevada (the Mercury) has decreased very little. Conditions at New Idria are more favorable than at other mines in this State. The average cost at all mercury mines in the United States over a period of five years was $50 per flask, indicating a loss of $15 per flask.

Murray Innes of the Oat Hill and Oceanic mines took issue with Mr. Gould regarding the question of ore-reserves, and thought the deposits in America extensive. If a fair price were assured for the metal we could keep up the output, otherwise Europe could flood the market. Mr. Innes thought the average ore in this State does not carry 8 lb. per ton. The future is uncertain, owing to the War. Metal sold to the Government by several producers has not been paid for in several months.

E. B. Crane of the Black Butte mine in Oregon considered that insufficient prospecting has been done to ensure the future output. In the case of his mine the suggested duty of $35 per flask would be too low. A new concentrating plant is now at work, recovering 85% from a soft disseminated ore carrying 4 lb. per ton.

H. C. Davey of the Guadalupe mine, California, thought that producers should enlarge their vision so as to consider consumers. The high-grade cheap-labor interests in Spain could dump metal here, and a tariff could not prevent it. The Spanish ore is evidently sorted up to the 14% previously cited. Owing to the pockety nature of the deposits, prospecting accounts for 75% of underground costs in America. There are large bodies of low-grade ore in California.

W. C. Crittenden, attorney for several quicksilver companies, took exception to statements concerning the quantity of ore available in this country. On account of the uncertain future no capital can be raised for developing prospects. When the War is over the demand for fulminate will drop considerably. Europe has increased its output, and a flood of cheap metal will threaten our market. A reasonable price for the metal is necessary to prevent this. E. de Golla of the Etna mine corroborated Mr. Crittenden's remarks.

George Roeth of the Great Eastern mine gave a résumé of quicksilver mining in California, stating that the average grade through many years was 0.5%.

C. E. Humbert of the Culver Baer Mining Co., Sonoma county, said that half of the men engaged in such operations are prospecting and half are mining. All the cost of looking for ore should be charged to mining. If the future were assured, capital might be interested.

Andrew Rocca of the Western Mercury Co., Sonoma county, considered that it was impracticable to charge capital with the cost of prospecting in the case of a quicksilver mine. There is plenty of ore here, but some protection is necessary. The grade in his mine is 10 lb. per ton. The total cost is $68.49 per flask, including depletion charges. Only the best ore is extracted on account of present conditions. At the Helen mine in Lake county, as low as 3 lb. per ton made ends meet.

C. W. Haas, selling agent for several Californian producers, said that there had been no imports for 18 months. (F. L. Ransome here interposed to say that a total of 710,000 lb. came from Mexico in 1916 and 1917.) His firm did import Spanish metal. There should be a duty put on the metal. When prices were high there were many offers from England, but when the price dropped these ceased.

Charles Bondies of the Study Butte Mining Co., Terlingua district, Texas, said that there were large deposits in Mexico.

Leslie Oliver, of the California Cap Co., a consumer, said that at present the consumption of mercury as fulminate is large, but substitutes are in use for detonators. The powder manufacturers are keen to have the production maintained. Substitutes for fulminate are effective, but they will not exclude mercury; they require some fulminate to detonate them, although they reduce the amount of fulminate required as much as 75%. Substitutes were so cheap prior to the War as to equal mercury at $41 per flask. No Ordnance Department, however, will accept substitutes for detonators in shells.

L. H. Duschak of the U. S. Bureau of Mines, who has been making a metallurgical investigation on mercury, said that a survey of the deposits in this country is under way. The present recovery in California is from 75 to 80%, but 90% is practicable. At Idria in Austria the recovery is about 90%. Fuel consumption in the Herreshoff furnace is 1½ times greater than in the Scott type; it makes more dust. The scope of concentration is limited, but furnace treatment will hold its own.

W. W. Bradley, of the California State Mining Bureau, gave excerpts from a new bulletin entitled 'Quicksilver Resources of California.' He exhibited a map of the State showing the quicksilver belts. From 1850 to 1917 a chart indicated three periods of large production —1861 to 1869, 1875 to 1883, and 1914 to 1918—concurrent with low prices, immediately following high prices. Normally the United States used 25,000 flasks per annum, against an output of 20,000 flasks, the difference consisting of imports. Half of the metal in peace time is used for fulminate. It is an essential metal at all times, and the industry should be fostered, protected, and maintained. There are undeveloped deposits in this State. The present duty of 10% ad valorem is not sufficient to protect the demostic industry. Spain is the greatest factor in the world's markets.

H. W. Gould added that the Santa Barbara mine, in the Huancavelica district of Peru, closed since 1789, is being re-opened by E. E. Fernandi of Lima. It produced 1,500,000 flasks up to 1790, this being more metal than any other mine in the world has yielded. It may be a factor in the market.

Murray Innes added, from conversation with H. C. Buckminster of the New Idria company, that there is practically no quicksilver in New York today. If it were not for the Government action in fixing the price for 40% of the output at $105, the present price would be $150 or more.

F. L. Ransome detailed the uses of mercury, namely, in drugs, electric apparatus, batteries, vermilion, amalgamation of gold and silver, measuring-instruments, paints for ship's bottoms, cosmetics, for floating lights in lighthouses, and in power-plants (a new use). Substitutes can be used in place of mercury, but their cost may be too high. An estimate of American requirements for 1918 is 36,166 flasks for all purposes. There are five producers in Texas, four being in the Terlingua district where the ore is considerably richer than in California, much being mined that yields 4%. Most of the high-grade ore now has been extracted.

G. McM. Ross gave some of his experiences in the use of quicksilver in the treatment of gold and silver ores. He did not favor a tariff, but a bounty on the metal.

Charles G. Yale, of the U. S. Geological Survey, said that the gold mines of America used 100,000 lb. of mercury per year in catching the metal, 45,000 lb. of which is used in California. The Kennedy mine at Jackson, with 100 stamps dropping, used only 1275 lb. last year, equal to about 0.007 lb. per ton of ore.

The hearing on tungsten was held on June 28. There were over thirty present.

Production in the United States has been as follows:

Year	Tons of 60% WO_3 in U. S.	Average price per unit
1908	671	$5.70
1909	1,619	6.30
1910	1,820	7.60
1911	1,334	5.90
1912	1,330	6.30
1913	1,537	7.30
1914	990	7.30
1915	2,332	15.40
1916	5,849	33.50
1917	4,800	20.80
1918	(estimated) 4,000 to 4,500	$16.00 to 26.00

J. H. Mackenzie, at one time connected with the Atolia Mining Co. in California, said that the production of tungsten in 1918 would be less than in 1917 and the imports would be greater. For the first four months of 1918 the receipts were 2382 tons of 60% concentrate. Some of the imported materials is impure, but it commands a ready sale. The imports come chiefly from the Orient, Mexico, Portugal, and Bolivia. The last-named deposits are from placers and lodes in the mountains. In 1917, 4880 short tons was imported. Portugal produces 3000 tons per year. That country has fixed the price at about the same as the present American prices, namely, $20 to $24 per unit. Some Korean mines produce tungsten as a by-product [notably the Soctarie mine of the Seoul Mining Co.—EDITOR.] Prior to the War the United States used little tungsten. Atolia formerly shipped concentrate to Germany. Mr. Mackenzie attributes the drop in output to the drop in price due to accumulated stocks. The ferro-tungsten stocks of 16 consumers on May 1, 1917, were 517,572 lb.; a year later they were 545,575 lb.; ore and concentrate, 1,134,379 lb., and a year later 2,370,219 lb. was in stock; high-speed steel stocks in May 1917 were 3,555,257 lb., and a year later 5,269,958. Reducing all to a 60% basis 3,690,720 lb. was on hand May 1, 1917, and 5,757,640 lb. a year later. Between 900 and 1000 tons of concentrate was in Eastern warehouses on May 1, 1918. His opinion is

MAP OF THE UNITED STATES SHOWING SITUATION OF TUNGSTEN DEPOSITS

that there will not be much change in the market this year. Consumers' wants for 1918 are 11,575 short tons of 60% WO_3. The newest use of the metal is for aeroplane engine-valves, containing 4 to 10% tungsten, employed in the steel valves and seatings; it makes them wear better. A number of producers stated that it was a matter of price alone that would increase the output. At least $35 per unit was necessary for this. The American deposits contain substantial tonnages of 0.5 to 0.75% ore, too low at present prices to interest capital. Colorado has no large deposits of low-grade ore, that is, below 1%. The highest grade being mined by the Atolia company is between 2 and 8% ore. This mine is worked to a vertical depth of 500 ft. This is not considered a big resource, as the bottom levels do not look so well as the upper. The future output of this country will come from California and Nevada. The Nevadan ores carry from 1 to 3%; those near Bishop, California, about 1%. The cost per unit of 60% concentrate in Colorado is twice that of California and Nevada. The peculiar mining necessary is responsible for this. The operating cost at Atolia is about $8 per unit. The total cost of the Bolivian product is $15.75 per unit, laid down at New York; and $11.60 from China. No Burma ore comes to America at present. That country, Bolivia, and America produce similar quantities. The Burma cost is $12.25 per unit. The world's consumption of tungsten is 21,000 tons, and the reserves are probably not more than this total, that is, assured. The British and French governments are trying to arrange with the United States to allocate the world's output, for the period of the War, but the terms have not been settled by this country. None of the Allied countries find molybdenum satisfactory as a substitute for tungsten in steel, although the Germans must be using it. The average recovery of tungsten by concentration is 75%. Stage-crushing and more careful classification will help to improve this. Tungsten minerals are not amenable to flotation.

W. W. Bradley of the California State Mining Bureau gave a list of the known tungsten prospects and producers in this State. Californian production has been as under:

Year	Tons	Value
1917	2,458	$3,068,331
1916	2,270	4,571,521
1915	962	1,005,467
1914	....	180,575
1913	....	234,673

Inyo, Kern, Nevada, and San Bernardino are the producing counties. The last is the richest, on account of the Atolia mine, which accounts for 50% of the State's total. The Inyo County deposits may be called disseminated; the ore carries under 1%. Four mills are at work near Bishop. Apart from Atolia and Bishop, the output of California is from small mines. Losses in slime are probably responsible for the present low recovery. The possibilities of finding ore in this State are good, provided the market remains favorable.

F. L. Ransome gave Mr. Hess' figures of cost as $6 per unit at Atolia, $10 at Bishop, $5 near Toulon, Nevada, and $20 at Boulder, Colorado. G. B. Ackerman gave some information on the Nevada deposits. Costs near Sodaville have been $5 per ton. This was in mining high-grade scheelite. Mineral and Humboldt counties contain big deposits. Production in Nevada fell-off after the price receded from $40 per unit. In 1915 the output of Nevada was 55 tons, and 689 tons in 1916. Joe Beane, who had knowledge of the property at Sodaville, stated that it is costing $16.85 per unit at the present time. The ore averages 4.2% tungstic oxide.

Samuel Kahn, representing H. M. Byllesby & Co. of Chicago, said that his firm became interested in a mine near Lovelock, Nevada, in 1916. They are concentrating custom ore from the region, including the Mill City district. His firm considers that a higher price would stimulate production in this district.

F. W. Griffin, of the Tungsten Mines Co., considers that the future of the industry lies in the low-grade ores. His company at Bishop, California, is milling 0.5% ore. If a price of $28 to $30 were assured for some years, production should be maintained. The tariff should be arranged toward this end. Freight on concentrate to the East is $35 per ton, plus the recently increased rate.

P. J. Osdick, producer at Atolia and president of the Rand Mining District Association, read a statement prepared by this Association. The stabilizing of the market, the elimination of middlemen or dealers, and the licensing of buyers, samplers, assayers, etc., is desired. The production of the Rand-Atolia district has declined since July 1917. Only $20 per unit is offered by the one buyer in the district. Martin Conroy interposed here, explaining that the local assayers gave a lower return than assayers in other centres. Between the broker and assayer the small miner did not receive his full value, he being at the mercy of these dealers, whose Eastern connections are not known. A great deal of leasing is done in this district, the leases being on a royalty basis from 15 to 50%. The two companies that had a regular output received several dollars per unit more than did the lessees. Waldemar Schmidt explained that royalties are on both a cash basis and on a sliding scale, depending on the price of the metal. He also said that the Atlas Crucible Steel Co., of Dunkirk, New York, eventually gets the product of the small mines.

R. A. Kinzie of the Tungsten Mines Co., Bishop, California, considered that the local deposits were larger than those in San Bernardino county. The future of the industry, as in other metals, depends on the low-grade formations. Near Bishop they are garnetiferous and are the lowest grade in the world. The Tungsten Mines, Standard Tungsten, and Round Valley companies are mining similar ore. The deposits do not persist; so far nothing was found below a depth of 260 ft. The cost at Bishop is $21.80 per unit, including operation, capital, interest, and depreciation. A fair depreciation charge for a tungsten mine is 50%. Joseph Beane stated, in support of this, that several companies that had spent up to $375,000 in Nevada had suspended work in less than a year. The cost at Bishop is between $5 and $6 per ton of ore milled. A preferred price would be $25 to $30 per unit.

The War-Minerals Bill

Testimony of WALTER R. INGALLS, Editor of the 'Engineering & Mining Journal', Before the Committee on Mines of the House of Representatives

MR. INGALLS: Mr. Chairman, I have been asked to come down here and express my opinion about this bill. As I understand it, the prime purpose of the bill is to increase the supply of certain minerals, but more especially the manganese ore, pyrite, and chrome ore. The bill enumerates many other mineral substances of which the production is already at the maximum and whereof we have a surplus. For example, it enumerates the metal antimony, which at the present time is in the same depressed condition that are lead, zinc, and many of the major minerals. The production of other minerals that are included in this enumeration has already been so stimulated that we can say today that there is a superfluity rather than a deficiency.

There are other minerals mentioned in the list whereof it is extremely doubtful whether we can do anything whatever to increase the production in this country. Take, for example, tin. I understand that in the original draft of this bill it was contemplated to include copper, zinc, lead, and other major minerals which have since been excluded. I do not think the phraseology of this bill does exclude them. The bill speaks of the ores of arsenic and the ores of sulphur, for example, and our ores of copper are frequently ores of arsenic, and our ores of zinc are very largely ores of sulphur. So, if you think that in the first paragraph of this bill you are excluding zinc, copper, and lead, and perhaps even gold and silver, do not be too sure of that.

THE CHAIRMAN: Do you not think it would only be by a stretch of imagination that you could get that interpretation in this bill?

MR. INGALLS: Most distinctly, yes. Our zinc ores, for example, are regularly ores of sulphur.

THE CHAIRMAN: Do you call a mine where zinc and copper are being mined as the principal ore with a by-product some other kind of ore, or do you call them zinc and copper mines?

MR. INGALLS: We call them zinc and copper mines.

THE CHAIRMAN: Of course, we do not want to include them here.

MR. INGALLS: We commonly designate mines by the predominant mineral, but there is scarcely an important mine in this country which does not produce many substances from the same ore.

THE CHAIRMAN: Certainly, that is true. But are they known in mining law or in ordinary mining understanding, and in common usage and technical usage, or any other kind of usage—they would not be called ores in this particular mine, would they? Of course, you might find a little mixture of that kind in any ore you get out, and probably in some you would find them as by-products; but would it be your opinion that they would be included under the terms of this bill?

MR. INGALLS: I think they might. I think it would be desirable to make your language so specific that they would not be included.

THE CHAIRMAN: Of course, we do not want them to be.

MR. EVERETT SANDERS: Would you suggest that we include by specific terms copper, zinc, lead, gold or silver, or anything of that sort?

MR. INGALLS: I do not think we need any help at this time in the gold or silver mining or lead mining.

MR. SANDERS: But, considering the proposition from a technical standpoint, do you think the section ought to exclude certain of those things in order to make it perfectly clear that they were meant to be included?

MR. INGALLS: I do.

MR. COURTNEY W. HAMLIN: Do you think that by the use of the expression here that arsenic would, by any reasonable interpretation, be included in the mining of copper?

MR. INGALLS: We have a large production of arsenic in this country. We do not need to do anything to increase that production. I do not know of a single pound of arsenic, however, that is obtained from any ore except copper.

MR. OTIS WINGO: Your idea is that if we provide for control over arsenic in order to exercise that control completely we would have to take control of the copper mine from which you would get it? Is that your idea?

MR. INGALLS: You certainly would.

THE CHAIRMAN: Let me call your attention to this proposition: That does not necessarily mean if you have a super-abundance of arsenic in this country being produced that the Government would do anything except possibly look out for its distribution, and so on; that the Government would not go in and mine arsenic when there was a super-abundance of it being produced.

MR. INGALLS: I should hope not.

MR. WINGO: Would you think this, that the question of control of the arsenic lies in the State? I am not familiar with those things, but for illustration, let us say, that arsenic was being used in steel production, and we had undertaken to control the price of steel. Do you not think it would be a matter of fairness in order to stabilize the market so that these people would have some assurance as to what the prices of these different materials that enter into that production will be? Would that be a proper and a fair thing to do?

MR. INGALLS: I do not think we need any stabilizing of the market. I think that efforts in that direction are

more likely to be mischievous than otherwise.

MR. WINGO: You do not believe in price fixing?

MR. INGALLS: Absolutely not.

MR. HAMLIN: Am I correct in saying that arsenic is a by-product of copper?

MR. INGALLS: Of copper ores.

MR. HAMLIN: You say if we control the production of arsenic we would have to control the copper mines.

MR. INGALLS: I do not see how else you could do it.

MR. HAMLIN: Suppose the Government would take control of oleomargarine. You do not mean that that would give them the power to control the whole cattle industry, from the farm up on through to the packers?

MR. INGALLS: I wish you would cite some analogy which is more in my line.

MR. HAMLIN: Oleomargarine is a by-product of the cattle business; you know that?

MR. INGALLS: Yes.

MR. HAMLIN: If we were to undertake to control——

MR. SANDERS: I do not think oleomargarine is a by-product of the cattle business.

MR. HAMLIN: Is not oleomargarine a by-product of the cattle business? What is it made of?

MR. SANDERS: It is made out of a great many things.

MR. HAMLIN: It is a by-product of the steer, is it not? Is that not a fact?

MR. INGALLS: I do not know about that.

MR. HAMLIN: I understand that oleomargarine, a substitute for butter, and the very best quality we can get, is made from certain portions of the beef and is manufactured by the packers at Chicago and everywhere else. The point I want to get at is this: Is it not true that while arsenic may be extracted from copper ores, that is done only in negligible quantities; that is, compared to the principal amount of copper produced?

MR. INGALLS: It is relatively small.

MR. HAMLIN: Negligible.

MR. INGALLS: Relatively small.

MR. W. FRANK JAMES: Let us take Mr. Douglas, for instance, who is the president of a company owning and operating a copper mine. Do you think because they manufacture some arsenic that this bill is so broad that under its terms the Government would control his entire output of copper unless there was some amendment made?

MR. INGALLS: I think that the mine administration, under that authority, might step in and attempt to control the whole output.

MR. JAMES: You think it would not only control the market on arsenic, but his entire copper product?

MR. INGALLS: They probably would not undertake to control the price of the copper output, but they might indirectly undertake to control the way he was doing his business.

MR. JAMES: Do you mean to say that in order to get some arsenic they have to go down there and take control of his copper mine and run his business, and then turn it back to him again.

MR. INGALLS: It seems to me that is true.

MR. JAMES: You do not think that is the intent of the bill, do you?

MR. INGALLS: I do not think it is.

MR. HAMLIN: What proportion of the arsenic that we use do we produce in this country?

MR. INGALLS: The production is possibly 4000 or 5000 tons a year.

MR. HAMLIN: What percentage of that which we consume do we produce in this country now?

MR. INGALLS: I think we produce all our arsenic. I think there is a capacity to produce a superfluity of arsenic.

MR. E. S. BASTIN: The production is about 60% of the consumption at the present time. My understanding is that we are not self-sufficient at the present time, but that, however, if a contemplated smelter is built by the Anaconda Copper Co. we are likely soon to become so.

MR. HAMLIN: About 60% now?

MR. BASTIN: Yes, sir.

MR. INGALLS: You are talking about a smelter being contemplated by the Anaconda Copper Company.

MR. BASTIN: I understand they are building a plant to recover arsenic, or that they have plans drawn up for a plant which will yield an output that will practically make us independent, but that we are not now independent.

MR. INGALLS: Very likely that is so. The Anaconda Copper Co. has been the largest producer of arsenic for years, and if our production has lately been insufficient, the Anaconda Copper Co. has stepped into the breach and supplied it. Our raw materials for the production of arsenic are probably superfluous.

MR. HAMLIN: What is the relative production of arsenic and copper in this country?

MR. INGALLS: The production of arsenic to copper is a mere speck. I suppose that the annual production of arsenic is in the neighborhood of 5000 or 6000 tons a year, while our production of copper last year was 1,800,000,000 pounds.

MR. HAMLIN: So the amount of arsenic, as compared with the amount of copper, is quite negligible.

MR. INGALLS: A mere speck. Then, in the matter of investigation as a means of increasing the production and eliminating wastes in tin and in tin scrap and other things, I do not think that this bill confers one particle of authority in addition to what is already being exercised by bureaus of the Government. In the matter of commandeering supplies when necessary, the Government is already doing that. We do not need to have any more authority. Coming back to the main purpose of the bill, the increase in the production of manganese ores, pyrites, and chrome ores, the production of those ores is already being stimulated feverishly under the influence of high prices. Our production is increasing every month by leaps and bounds. It may be necessary to do more. Some of our friends say it is, and I will not dispute that proposition. Please understand I am not opposing the purposes of the bill. But if that is the purpose, why not go directly at it and say that we hereby appropriate to

the Secretary of the Interior the sum of $50,000,000 with which to go and get manganese and pyrites. It seems to me that what is in mind in the bill is excellently illustrated by the case of chrome, which we get substantially from nowhere except in California. In California there are numerous small deposits which have been worked, and the effect of increasing production so long as they are reasonably near the railroad might be good. In order to increase the production of chrome ore it is necessary to go to more remote deposits and build in there branch lines of railways or highways for bringing out the ore, which it is represented that private capital is unwilling to do because of the uncertainty of the market. Very well, then, let the Government, through the Secretary of the Interior, or any other proper medium, back those people for that specific purpose. But why guarantee a price to everybody, including those who are already working their mines at a profit? Let them alone.

THE CHAIRMAN: Do you think it will be the intention of this bill, or anybody who was administering it, to guarantee a price to the people who are supplying sufficient quantities of these ores at proper prices which might be discovered after an investigation by the bureau?

MR. INGALLS: How else are you going to do it?

THE CHAIRMAN: If you say they are already receiving a profit and they are working their mines to the fullest capacity and getting plenty of ore out of them, do you think the Government would do that?

MR. INGALLS: I should hope not.

THE CHAIRMAN: I would say I would not be for the bill if I thought they were going to do that. Nobody connected with this committee or with the Government imagines for a moment that such a thing would be done.

MR. INGALLS: It seems to me that this bill has got to be fixed in order to take care of that.

THE CHAIRMAN: We have got to trust men with some judgment and common sense in those things when it comes to a matter of that kind. Certainly we have more confidence in the Government than to believe that the Government officials would do such foolish things as that. Do you not think so?

MR. HAMLIN: What mineral mentioned in this bill is now being produced in sufficient quantity with a prospect of being able to meet the increased demand occasioned by the War? Will you please name those you think are in that category?

MR. INGALLS: So far as antimony is concerned, our main supply comes from China.

MR. HAMLIN: I do not think you understand my question. I got the idea from your statement that we had included in this bill certain minerals that are produced in this country in sufficient quantities to meet the present demands, with a prospect of meeting future demands, at a profit. I asked you to name those and not to name those which are not produced in this country.

MR. INGALLS: We are producing sufficient arsenic; we are producing sufficient magnesite; we are producing sufficient mercury; we are producing sufficient molybdenum; we are producing sufficient tungsten.

MR. HAMLIN: And you think the prospects are good enough so that we can trust to the future for the supply of any increased demands that may come upon these mines, that they will be able to meet them?

MR. INGALLS: I do not see any necessity for interfering with those mines, either with assistance or by restraining language.

MR. MAHLON M. GARLAND: It was explained here by some one that it was necessary to increase the output because of the fact that we have to supply our Allies, and also that it is necessary to relieve the ships that are carrying that stuff from China now, but that the more special need is to supply our Allies, and that while we were getting enough for this country the demands for these things by our Allies are increasing.

MR. INGALLS: The use and importation of many of these minerals is a very small tonnage business. In this whole list the only big tonnage imports are those of manganese ores and pyrites.

While it is true that the bulk of our antimony comes from China, the total use of antimony is but a relatively few tons, and it is heavy freight, and it comes in ships that are bringing light shipments, and it is very questionable whether the exclusion of such a small tonnage would really accomplish anything. How much money ought we to spend in this country to develop very lean and poor antimony mines in order to save the bringing in of a very few tons of antimony from China, which would probably come along in a ship that is bringing something else anyway?

MR. WINGO: Suppose we were to put an embargo on those light Chinese things we do not need in this country and which are now being brought over in ships on which our antimony comes, and that it is desired to save all of that shipping. As I understand it, the rule now is that 1 ton of ore can make way for about 5 tons of food. As I understand it, that is what they figure on. What would you do in order to make up the deficit in any of these different metals which are necessary, even though they may be necessary only in a small amount; how would you go about doing that?

MR. INGALLS: I should say in the first place that the premise is impossible. We could not put embargoes on everything. We could not put an embargo on tin, because we would not get any tin.

MR. WINGO: I said we might put an embargo on the light things coming from China, which you mentioned and which are unnecessary. Evidently we get a great deal of stuff from China which we do not need now, and the need for ships is so great that if an embargo has not been placed on them it should be. Suppose we eliminate all that stuff, and we find that the need for ships is so great upon the Atlantic coast that they find it necessary to take the ships which have been bringing that unnecessary stuff across the Pacific and bring them around to the Atlantic coast for the purpose of furnishing supplies to our Allies and to our own men. Then practically all of the supply of antimony that has been used to meet domestic needs in this country would be thus

shut off, and we would be shut off from the supply we got from abroad?

MR. INGALLS: If you are going to do that, the only thing you could do would be to work our lean mines and get what you could from them, regardless of the expense.

MR. WINGO: Could not you develop new antimony deposits or develop some that are already known of and are undeveloped?

MR. INGALLS: Before the War the normal average price for antimony was in the neighborhood of 8 cents a pound. At the present time the market price is a little over 12 cents a pound. Although that, in figures, is a high price, relatively it is a low price, because it simply measures the expansion that we have had in everything. In the early days of the War antimony rose to something like 45 cents a pound. For long periods of time it was up in the forties, and it failed to stimulate our antimony production.

MR. WINGO: Did it not open up any new mines?

MR. INGALLS: Not to speak of.

MR. WINGO: What do you mean when you say "not to speak of"? Did it open any that you know of?

MR. INGALLS: I think that during that period the old mines in Arkansas were operated spasmodically, but there were no antimony mines in this country operated sufficiently to make any material production.

MR. WINGO: Where was it in Arkansas where they had old mines which had been worked prior to that time, and what deposits were there that had ever been worked before the War?

MR. INGALLS: I cannot tell you the names, but there are some old antimony mines in Arkansas.

MR. WINGO: Old antimony deposits that have been incorporated and driven down to demonstrate that the antimony was there; but was there ever any ore shipped in commercial quantities from Arkansas prior to the War?

MR. INGALLS: I think so.

MR. WINGO: Why do you say it is impossible for us to put an embargo upon non-essentials? If it is necessary to put an embargo upon the ores we are getting from China, why do you say it is impossible for us to put an embargo on these other things in order to save the shipping for foods and supplies to our Allies and our men, and then by that very process encourage the opening up of old mines, as you suggested, and new, undeveloped deposits? Why do you say it is impossible for us to do that? You said it was impossible.

MR. INGALLS: I said it was impossible to put a general embargo on those things, which was your proposition.

MR. WINGO: I did not say general embargo. I said a special embargo on these unnecessary things. Why is that impossible? Are we not doing that very thing now? Has not the President of the United States put an embargo on various things? Have you not overlooked the fact that the prime purpose is to save ships which are now being used to carry such things as these light unnecessary things which come from China? In order to encourage the opening up of undeveloped deposits of such things ought we not encourage capital to go in and develop them and not let it be left broke by a sudden and unexpected cessation of the War?

MR. INGALLS: You make it a business proposition. The question is whether it is better to save one ship or two and use the labor of many hundreds of men and much material in order to get something out of an uneconomical proposition.

MR. GARLAND: Take the case of pyrites. As I understood it from the statements that have been made here, it requires 5 ships to bring the pyrites we use in this country now from Spain. Is there any way of relieving that? Pyrites are very cheap, as a rule, and there are a great many mines in this country, are there not? Are we doing anything in the way of developing pyrites mines now?

MR. INGALLS: Yes.

MR. GARLAND: Are they able to mine pyrites at a profit at the present time?

MR. INGALLS: The prices are high. The stimulus of high prices is increasing the production of pyrites. We have also other means of increasing our production of sulphuric acid, namely, through the wider use of zinc blend, and even through the use of brimstone. Mind you, Mr. Chairman and gentlemen, I am not opposing the principle of this bill, or the desire to increase the production of these minerals and metals by a governmental subsidy or bonus. I do advise that the bill say more specifically what it aims at, and create more specifically an authorization to the Secretary of the Interior, or some bureau of the Government, to go out and get these things, as would be done in business, and so let our industry, that is well able to take care of itself, let that part of our industry alone.

MR. GARLAND: I see your point there, as you have stated it. I mentioned pyrites because it was stated here that we could save a large tonnage by getting it in this country. We are now getting pyrites at a price that recompenses those producing it in this country, but not enough of it. Your idea would be that if there is a pyrite mine located where that stuff can be secured, but which is a long distance from a railroad, that the Government should step in and build a road instead of raising the price or guaranteeing the price for that mineral.

MR. INGALLS: Yes.

MR. GARLAND: It seems to me that looks reasonable, too.

MR. INGALLS: If the Government wants to do that.

MR. GARLAND: If they want the pyrites, they would have to.

MR. INGALLS: The normal increase in the market price, the advance in the market price, has automatically increased the production of these substances, and at the same time it has curtailed the consumption of things that are unnecessary. Take, for example, the matter of chrome ore—the advance in price and the increased production of chrome ore. At the same time it has or will decrease the use of chrome ore for refractory material.

BUTTE, MONTANA, WHICH IS PRODUCING AN ESSENTIAL METAL

IN THE HEART OF THE MOUNTAINS, WHERE WAR MINERALS ARE FOUND

It will give an available supply of chrome ore for the manufacturers of ferrous alloys and ferrous chrome, and for the people who are now using them for refractory material, and they can also use magnesite, of which we have an ample supply. Magnesite serves quite as well for their purposes, and there is a point in the price where they will do it.

MR. GARLAND: The point made by gentlemen who appeared here on the first and second days of these hearings was that it was necessary to speed this matter up; that it is absolutely necessary to do this at once; and that they cannot wait for the development in the manner in which you speak, and therefore the necessity of this bill.

MR. INGALLS: Very well. Simply say to the Secretary of the Interior—I speak of the Secretary of the Interior because I agree with my friend Mr. Douglas that the industry has confidence in the Secretary of the Interior and his bureaus, and we do not have confidence in commissions that are stepping in to take a part in our industry—say to the Secretary of the Interior, "Here is $50,000,000, and with that go out and get manganese or pyrites or chrome ore in any way you see fit, because we want it in a hurry."

MR. GARLAND: I see the point you are making.

MR. HAMLIN: Then suppose the producers would get together and say to the Government, "You will have to pay us a certain price," which was an unconscionable price, "because you cannot get it anywhere else." Then you would leave the Secretary of the Interior at the mercy of the producers when he comes to expend that $50,000,000. What are you going to say then?

MR. INGALLS: You contemplate the organization of a combination?

MR. HAMLIN: I contemplate that that is within the range of possibility under that scheme, and I also contemplate that without this law or some similar provision these sources that are now producing quite sufficient quantities of certain of these vital necessities might do that for the purpose of enhancing the price or reducing the amount of production so as to create an artificial demand. That is within the range of possibility. It has been done before, and, unfortunately, we have some people who might do it again.

MR. INGALLS: We are conducting a very great mining industry. These matters of manganese ore and chrome ore are very important, but in comparative magnitude with other branches of our mining industry they are relatively insignificant. I have not observed any desire or any effort on the part of anybody to hold up the Government. On the contrary, my own observation has been that everybody is patriotic and that everybody is competitive, and I cannot conceive that anyone who had a production of manganese ore would fail to sell it as quickly as he could at the going price.

MR. HAMLIN: Let us hope that is true. But do you not think that in these times of national stress and peril it is the part of wisdom and statemanship to do everything that is necessary to be done to be able to control any situation that might arise, and if these parties are patriotic, as we all hope they are and as we have every reason to believe they are, they could not and would not complain at any Government restrictions or control?

MR. INGALLS: If that condition arises, the President would simply step in and commandeer the supply, as he has already, through the various departments, commandeered supplies of other needed substances.

MR. HAMLIN: That is just like surgery. We prefer to apply the less heroic remedies, unless it becomes necessary to perform a capital operation, and this bill seeks to provide a way so that it may be less disturbing to the business interests of the country by regulating it, and then everybody will understand how to take it and it will not be necessary to resort to radical measures.

MR. WINGO: Is not this the trouble, that we have been following your plan for 12 months, and I do not suppose anybody is satisfied with the progress that has been made. Is not this one of the measures by which we can proceed to do directly what we want to do and speed up things and get what we want right now and go ahead and win the War?

MR. INGALLS: There has not been the stimulus of high prices in connection with these particular things until quite recently.

MR. WINGO: In some instances there have been some cases, in extreme instances, where the Government has not gotten much help, except in the way of depleting the Treasury. But I think all industries ought to remember this, that we cannot shut out privateers altogether. The fact is that we have not gotten to the point where we have a sufficient supply in this country and must shut off all the tonnage which is used in importing that stuff, so that we can use that tonnage in carrying the most important things to Europe. Is not that the practical thing, and can we meet that by an academic eulogy of the thing which I admire as much as you do, and that is the law of supply and demand. I have very great respect for the law of supply and demand. I am a great believer in that myself, but we have reached the point where our customary economic theories fail, and so is it not our duty to try something else to see if we cannot get better results?

MR. INGALLS: My observation has been that our customary economic theories have not failed.

MR. HAMLIN: It is a very serious situation, which from all reports seems to be confronting us now, so far as our shipping goes. You realize that, do you not?

MR. INGALLS: Surely.

MR. GARLAND: I would like to have the gentleman go on and state what he would further advise along those lines, by way of amendment of the provisions we have in the bill which is before us.

MR. WINGO: That is the point I was trying to get at. You are a practical man and we want to have the benefit of your suggestions. If this is a plan that is unnecessary and that will not work, tell us some other plan that will help to speed up the matter and save the shipping.

MR. INGALLS: I should say as a practical plan that the best method would be to create a United States Mining Corporation, with all the capital stock owned by the

United States Government, with sufficient capital to accomplish the purpose that is desired, and, in general, instructions should go out to increase the production of manganese and pyrites and to go out and get that. If it were not desired to do that I should say simply appropriate for the use of the Secretary of the Interior the sum of $50,000,000, or whatever is deemed desirable, with the simple instructions to go out and get these minerals.

MR. JAMES: At what price?

MR. INGALLS: In any way he can. If you want a thing very badly, the price does not cut much figure.

THE CHAIRMAN: That would require commandeering to get that stuff, would it not?

MR. INGALLS: I do not see why it would require commandeering. It would simply be an ordinary business method.

THE CHAIRMAN: You mean you would send the Secretary of the Interior out with $50,000,000, send him out throughout the country to buy the necessary war materials?

MR. HAMLIN: At any price?

THE CHAIRMAN: At any price.

MR. INGALLS: I would send him out to get the materials in any way he could get them.

MR. HAMLIN: At any price he sees fit to pay?

MR. INGALLS: At any price he sees fit to pay.

THE CHAIRMAN: If they asked him $2 for a pound of an article which was ordinarily worth only 50 cents, he would pay that amount; is that your idea?

MR. INGALLS: I assume he would be properly advised.

THE CHAIRMAN: But he would have to buy it. You said you would not commandeer it, but you would buy it. You could not take a man's property under your plan. If you go to him and say, "I want so many pounds of pyrites," and he had it, and he said, "I will not sell it to you except at a certain price," the Government would have no power to get it except by paying the price he asked for it. Do you not think the Government in that case ought to have some right to fix the price, which would be reasonable and afford the man who was mining the mineral a reasonable profit?

MR. INGALLS: It seems to me the natural competition among producers would give the Government the material.

MR. WINGO: Let us assume that we have shut off the imports in order to save the shipping. Then suppose a man would say, "I want to help you, but I cannot afford to go into this thing, to put in money for improvement and take a chance on the War stopping suddenly. I would like to get my capital back, but under your proposition I would not get my capital back and would not get a reasonable return for the capital, considering the time it had been used." Do you think it would be a practical thing for the Government to do that, and do you think you would get the results? Do you think that men would feel that their patriotism required them to take that chance and to do that thing? Would not the Government get better results if we were to say, "We do not ask you to risk anything, but if you will put in the money necessary to open these deposits, we will guarantee you such a price for a certain length of time, and it will be a safe venture for you, and you can start at it without risking your fortune and everything you have in it."

MR. INGALLS: I suppose we could do that by contract.

MR. WINGO: Is not that what this bill practically does? We say to the Secretary of the Interior, "Here is $50,000,000. You go out and encourage the opening up of these deposits in this country and guarantee such a price for such a length of time that will make it an attractive proposition," and would not that encourage the very sort of thing you are talking about and encourage the sort of men you are referring to? Is not that what the bill proposes to do in a practical, direct way?

MR. INGALLS: I think that is what you have in mind.

MR. WINGO: That is what I want to get at.

MR. INGALLS: I think that is all right, but what I would like to see would be for you to protect that part of the industry that can take care of itself and do not give anybody the right to come in and interfere with things.

MR. WINGO: I beg your pardon. I think you said you would be in favor of taking over the project.

MR. INGALLS: No.

MR. WINGO: I thought you wanted to organize a United States mining corporation to go into the general business.

MR. INGALLS: I would have that corporation go into business as anybody else.

MR. WINGO: Do you not think that a United States mining corporation, organized with $50,000,000 of stock, would have a negative or depressing effect upon private producers? Does not a large corporation of that kind always depress the smaller man and make him more cautious in his investments? Can you conceive of a more powerful corporation than a United States Government mining corporation, clothed with all the powers of the Government back of it?

MR. INGALLS: I do think it would be a good business for the Government; I do not believe there would be any profiteering by anybody.

MR. WINGO: Certainly not, if you have socialism in this country. If you had that, you would shut out profiteering, except profiteering in controlling the Government. We would be trying to be directors of the governmental corporation. Is not the practical thing now to encourage the development of this stuff so that men will go out and get it and bring it to the Government? If that is the thing to do, and if we have not done it, what language would you suggest by way of change in this bill to make it more practical?

MR. INGALLS: I would change that language that gives anybody the right to interfere with a mining business that is being efficiently conducted at the present time by its private owners.

THE CHAIRMAN: Will you please point out where that is done in this bill?

MR. NATHAN L. STRONG: As I understand it, your criticism of this bill grows out of the conception that it is proposed to stabilize the general market rather than to render aid to the individual.

MR. INGALLS: I understand it so.

MR. GARLAND: Why would it not be proper if you make an increased price for any article to have all of them participate in it?

MR. STRONG: I interpret your idea that way.

MR. INGALLS: I am under that impression.

MR. WINGO: Do you think it is more practical for the Government to build a railroad for the benefit of this producer than to make a contract with a man and say it will take a sufficient amount of this stuff—say that it will take a certain amount of this material at a certain contract price for a certain number of years that will justify the man in making this expenditure, or do you think it would be better for the Government to build a railroad for him? Then, what would you do with the railroad, give it to him? Or would the Government operate the railroad when the necessity for it passes?

MR. INGALLS: It would come to the same thing.

MR. JAMES: Suppose the price of copper was not a sufficient price to make up the expenses? Would it not be better for the Government to guarantee a price to the copper miners than to take an undeveloped property and run a railroad from the mines and let properties already developed lie ilde?

MR. INGALLS: I have no doubt that if the Government would let things alone we would have plenty of copper and everything else.

THE CHAIRMAN: Right on that line, we have not plenty of these articles now in our own country, have we? We are not producing them?

MR. INGALLS: We have not right now sufficient manganese, sufficient pyrites, or sufficient chrome ore. This is an emergency that has come on within a few months.

THE CHAIRMAN: That is what we have to meet, this emergency that is on us.

MR. INGALLS: You have to meet this emergency. The stimulus of high prices will help you meet the emergency.

THE CHAIRMAN: Supposing shipping is interfered with between here and Spain, or between the United States and the point where we get our manganese, as it is now being interfered with, and the need for ships is so great for the purposes of carrying food and other supplies to Europe, so that we are deprived of those articles that are necessary. The emergency is here; what are we going to do about it?

MR. INGALLS: What is anybody going to do?

MR. CHAIRMAN: We are going to try to meet it by provisions of this bill.

MR. INGALLS: Private capital is already trying to meet it.

THE CHAIRMAN: But they have not yet met it.

MR. INGALLS: They are further on the way to meet it than anything which will be done under this bill.

MR. WINGO: Would this bill accelerate or retard their efforts?

MR. INGALLS: I should say it would do neither.

MR. HAMLIN: Then it will not harm anything?

MR. WINGO: You think it is a harmless piece of legislation, then?

MR. INGALLS: So long as the Government does not interfere with our industries and they are being successfully prosecuted, it is immaterial and it is harmless. It may be helpful.

THE CHAIRMAN: Will you point out where this bill would interfere, if you please? We would like to know that.

MR. HAMLIN: Is it not the licensing feature of this bill which you most object to?

MR. INGALLS: That is one feature.

MR. HAMLIN: Is not that your real objection?

MR. INGALLS: The bill is full of—

MR. HAMLIN (interposing): Regulatory provisions?

MR. INGALLS: Regulatory provisions of that character which afford some new commission authorization to come in and interfere.

THE CHAIRMAN: Let me ask you this question: Do you believe in war time that everybody ought to be turned loose to do just as he pleases, or has the Government the right to come in and regulate the absolute necessities in war times?

MR. INGALLS: The Government has an absolute right.

THE CHAIRMAN: Do you think they ought to do that as a matter of safety for the country and for the successful prosecution of the War, or ought everybody to be turned loose to do as they please?

MR. INGALLS: I am afraid that some of the things the Government has done in the way of regulating, with special reference to our industry—

MR. JAMES (interposing): Is not your real objection to this bill the fact that you are afraid this bill is simply a stepping stone to another bill to take care of the copper and iron industries? Is not that your real objection?

MR. INGALLS: No.

MR. JAMES: You are talking about mines already developed, and all these things have been already developed. The crisis is here. We have heard that from Secretary Lane and Mr. Baruch. The question is what are we going to do now that the crisis is here? If this bill will not take care of it, what plan will you suggest?

MR. INGALLS: I have not disputed that; I have simply advised confining attention to those matters in which the crisis exists.

MR. HAMLIN: If the present conditions are satisfactory, and we ought not to interfere in any way with them if you are right about that, this crisis would not have arisen, would it? If private capital and private industries engaged in these things are and had been equal to the emergency this crisis that is now conceded to be upon us would not have come, would it?

MR. INGALLS: The crisis is absolutely artificial. It becomes necessary to cut off certain importations. That is a condition which nobody in the normal market can foresee.

MR. HAMLIN: Certainly. It comes as the result of abnormal conditions throughout the world, for which we are not responsible. Now, then, what is our duty, as Members of Congress, under these existing conditions?

Ought we not to do something to try to meet this abnormal condition?

MR. INGALLS: I admit that.

MR. HAMLIN: Perhaps I have not understood you. The drift of your idea as it has impressed my mind is that we ought to do nothing. I understood you to say in answer to Mr. Wingo that we should not pass this bill, that private capital will take care of the situation if we will leave it alone.

MR. INGALLS: I beg your pardon; you have misunderstood me.

MR. WINGO: That is the impression I got.

MR. INGALLS: You have misunderstood me in that.

MR. HAMLIN: What is your remedy?

MR. INGALLS: Where you have misunderstood me is in this: I said private capital under the stimulus of high prices is already doing a great deal in these particular things. I said I am informed by the gentlemen who framed this bill that it is necessary to do something more.

MR. HAMLIN: Then, if high prices have already stimulated private capital, how could the Government step in and say to those same people, "We will guarantee you that the prevailing prices shall not drop below a certain point and interfere with the present stimulation of high prices. We are not fixing the maximum; we are only fixing the minimum." Ought that not to contribute to this stimulation?

MR. INGALLS: Yes.

MR. HAMLIN: Then how could you object to that? That is what this bill does.

MR. INGALLS: If people are already producing these things and do not need a guarantee of the minimum, why is it necessary to give it to them? I admit it is my understanding that this bill does that.

THE CHAIRMAN: Only if necessary to get the article.

MR. INGALLS: I believe there is a difference of opinion, that some think the guaranty may only be to some people and not to other people.

MR. HAMLIN: Not to be to some people, but it may affect some particular mineral and perhaps might not apply to others.

MR. INGALLS: You are going—

MR. HAMLIN (interposing): For instance, there is manganese produced in sufficient quantities so that the President finds that probably it may not be necessary for him to take any action in regard to that particular ore. But we give him the right to do it if it becomes necessary. But there is another ore which is mentioned in this bill and it becomes necessary for him to do that in order to stimulate it, and he is given the right to do.

MR. JAMES: It says, in section 14:

"That whenever the President shall find that an emergency exists requiring stimulation of the production of necessaries, and that it is essential that the producers of necessaries shall have the benefit of the guaranty provided for in this section, he is authorized, from time to time, reasonably and as far in advance as practicable, to determine and fix and give public notice of what under specified conditions are reasonable guaranteed prices in order to assure such producers a reasonable profit."

You do not suppose that applies to manganese; if we are producing more than we need, that there is going to be any stimulation given by the President in that situation for the production of manganese?

MR. INGALLS: That is the way I read the bill.

MR. JAMES: It says "whenever the emergency exists," and it would not exist if we were producing all we need.

MR. INGALLS: No.

MR. JAMES: Then it would not apply to manganese.

MR. INGALLS: Take the case of magnesite. The production is already increased, and some people have gone into the business and made large outlays under existing commercial conditions. Are you going to make a guaranteed price to them on top of that?

THE CHAIRMAN: Of course not.

MR. WINGO: It is only in those cases where, because of the uncertainty of the market, these mines do not attract capital so that these deposits will be developed. We actually need them now.

MR. INGALLS: Then you say you will stabilize prices for some people?

MR. WINGO: No; we are not doing that for the market. Take a practical illustration. Take, for instance, some of the things that are not being produced in sufficient quantities. There are men who are not willing to go out with the uncertainty of the market and develop those things, in the face of the fact that when the War is over and get back to normal conditions that property might not be a profitable proposition, and we would say to such men, "Would you be willing to put your money in a mine now, knowing that the guaranty that you would get would give you a reasonable profit on the capital which you would put in now, and which you might not be able to use after the War is over."

MR. INGALLS: I cannot answer that, generally. It is not a normal condition. We had the same condition in the zinc industry in 1916, where people put millions of dollars in a plant on preliminary figuring, with one year's amortization.

MR. WINGO: Suppose there is another place where private capital does not feel justified in going in and developing the ore. What are you going to do?

MR. INGALLS: Let the Government provide the capital.

MR. WINGO: You believe in giving subsidies instead of stabilizing prices and guaranteeing a contract for a sufficient length of time to justify private capital going into it?

MR. SAUNDERS: Doctor, I would like to ask your opinion about certain phases of this bill that you have not discussed and which, it seems to me, might lay the basis for some of the fears you seem to entertain. The thing which you fear more than anything else is that this regulatory bill, this legislation for the purpose of regulating these industries, may interfere with the industries and hamper them. Now, there are certain sections of this bill which I think might lay a foundation for that fear. Section 5, for instance, deals with the other parts of the situation. A good deal of the bill deals with the question of fixing minimum prices, and, of course, would encourage the industries; but there is another phase of

the bill which was not meant to encourage the industries, but which was meant to regulate them. For instance, section 5 permits interference by the Government whenever any royalty, charge, or commission or profit is unjust or discriminatory, and section 4 contains this language:

"That it is hereby made unlawful * * * to monopolize or attempt to monopolize, either locally or generally, any necessaries * * "

And that means necessaries enumerated in Section 1—

"to engage in any discriminatory or unfair or any deceptive or wasteful practice or device, or to make any unjust or unreasonable rate or charge, in handling or dealing in or with any necessaries."

In other words, the bill, in addition to providing a minimum price which would tend to encourage the industries, goes ahead and gives authority to provide a maximum price, and is not that the feature of the bill which really forms the foundations for your misgivings about it?

MR. INGALLS: Very much so.

MR. SANDERS: In other words, when you are fixing a minimum price, that tends to encourage production, and when you fix a price as a maximum price, if that price should happen not to be right, should happen not to be fair, that would discourage production. That occurred in the local industry when Dr. Garfield fixed a price which was not adequate for the small mines, particularly. Is not that the feature of the bill rather than the feature of the bill fixing a minimum price the one you have in mind?

MR. INGALLS: I have that very much in mind.

MR. SANDERS: What would you think about the provisions in the bill which permit the fixing of a price above which the producer cannot go and fixing the charges and commissions and royalties for all of this?

MR. INGALLS: I think it would be very dangerous.

MR. SANDERS: What would you think about the provisions in the bill which permit the fixing of a price above which the producer cannot go and fixing the charges and commissions and royalties for all of this?

MR. INGALLS: I think it would be very dangerous.

MR. HAMLIN: Gentlemen, it is after 12 o'clock, and the House has met, and we will be needed over there.

THE CHAIRMAN: Mr. Ingalls, we are very thankful to you for your kindness in appearing here, and we certainly appreciate it.

MR. INGALLS: Thank you, sir.

MAGNESIUM may be estimated rapidly, according to N. Busvold, by precipitating it from a mixture of calcium and magnesium salts by the addition of an excess of lime. After filtering and washing with an excess of lime, the precipitate is boiled with an excess of oxalic acid, and is thus converted into the soluble magnesium oxalate. The total oxalic acid is determined with permanganate, and the free oxalic acid is titrated, using methyl red as indicator.

Our War Finance Problem

Total expenditures of the Government from July 1, 1917, to May 15, 1918, were $10,365,629,602. For the period from January 31 to May 15, 1918, the average daily expenditure was approximately $39,000,000. On the assumption that the daily rate of expenditure for the remaining period of the fiscal year will be about the same as at present, the total expenditures for the remainder of the fiscal year would be $1,755,000,000, making a total of estimated expenditures of $12,120,000,000.

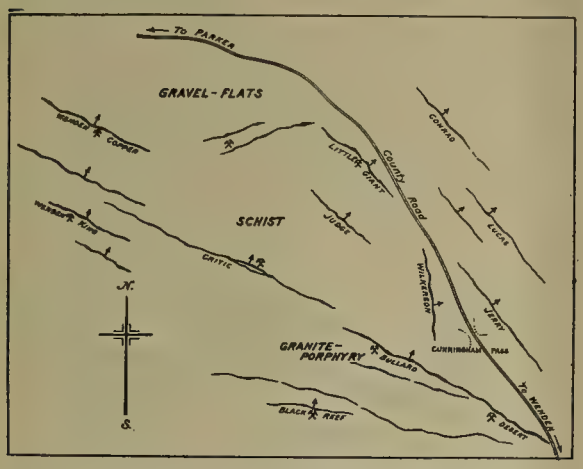
In view of the fact that the daily expenditures have been increased above the average, and in view of the fact that the operation of the war machinery is daily being extended, it has been thought advisable to add at least $150,000,000, which would make a total of $12,300,000,000 as the total estimated expenditures for the present fiscal year. The ordinary revenues of the Government, including Panama Canal tolls, less income and excess profits taxes from July 1, 1917, to May 15, 1918, were $1,063,345,638. On the basis of the average daily receipts from January 31 to May 15, 1918, of about $4,270,000, this total will be increased to $1,260,000,000. Various estimates have been made as to the probable returns from income and excess profits taxes for the present fiscal year. They range from $2,700,000,000 to $3,500,000,000. The latest estimate of the Secretary of the Treasury of the probable return of these two taxes is in excess of $2,700,000,000. On this basis the Treasury Department estimates that the revenue receipts of the Government as distinguished from proceeds of loans, will be about $4,095,000,000. Should this estimate of income and excess profits taxes be conservative, as many think, the receipts will be in excess of these figures.

The total advances to our Allies from July 1, 1917, to May 5, 1918, were $4,251,329,750. During the period from January 31 to May 15, 1918, the average daily advances to Allies were $10,670,000. On the assumption that the advances to our Allies will continue to the end of the fiscal year at the same rate, the total advances to them will approximate $4,750,000,000. If the total estimated advances to our Allies of $4,750,000,000 be deducted from the estimated total expenditures of the Government of $12,300,000,000, there remains $7,550,000,000, which would represent our own governmental expenditures. On the basis of the above figures, the percentage of total governmental expenditures to be met by taxes and ordinary receipts is approximately 33%. If the income and excess profits taxes yield a larger sum than has recently been estimated by the Treasury Department, this percentage will be increased. If the total estimated advances made to our Allies be deducted from our total expenditures, it is seen that we will pay at least 54% of our governmental expenditures from ordinary receipts and taxes. The deficit must be covered by loans. A part of our expenditures are for capital account and will finally yield revenue.—'Guaranty Trust Bulletin.'

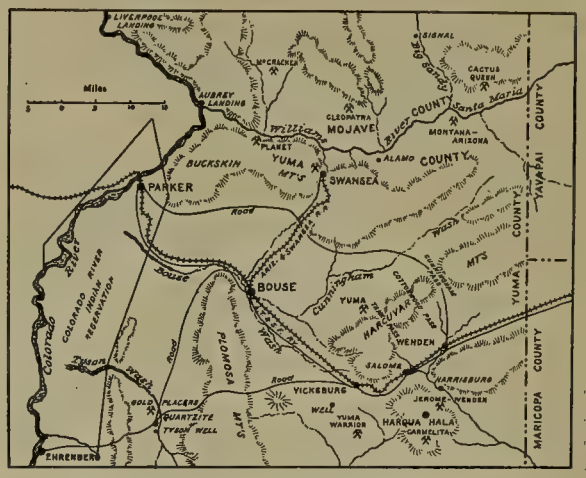
Cunningham Pass District, Arizona

By W. TOVOTE

The Cunningham pass country, in northern Yuma county, Arizona, recently has been attracting considerable attention. This is less because of the amount of ore being mined than for the fact that the ore is high-grade and of excellent character for smelting. Three mines are now producing steadily, others are in process of development, and small shipments are being made by lessees from undeveloped properties. The district is about 10 miles north of Wenden on the Arizona & California



SKETCH SHOWING PART OF VEIN-SYSTEM NEAR CUNNINGHAM PASS



SKETCH OF THE PARKER CUT-OFF DISTRICT IN YUMA COUNTY

branch of the Santa Fe system. It is part of the Ellsworth mining district.

Cunningham pass is a low saddle in the Harcuvar mountains. The main traveled road from points in central Arizona to Parker used to lead through this pass, but in recent years a new highway has been constructed along the railroad, which now takes most of the through-traffic. The country is a typical semi-desert. Water is scarce and wells supply most of the drinking water. Small towns and settlements have grown wherever water has been found in sufficient quantity. Vegetation is scanty, the mesquite and palo verde being the principal shrubs, and some ironwood is found along the arroyos.

Mining near Cunningham pass dates back at least 20 years. The Critic and the Bullard mines were started on rich surface-ores, and both produced for awhile. The Critic is credited with an output of $500,000 and the Bullard with $150,000. The Bullard was opened by four short tunnels, the longest being 320 ft., with a maximum depth of about 225 ft. vertically. Ore was also developed in two shafts. The ore-shoot in the tunnels was partly stoped and the mine closed because the owner did not care to operate it, while prospective buyers were reluctant to meet his price and terms. The mine has been worked intermittently since by lessees. The Critic is a shaft-mine. It was opened to the 400-ft. level and partly stoped, some good orebodies being overlooked. Lessees have operated it since with indifferent success, until J. Nohlecheck, about two years ago, opened several good ore-shoots, increasing the reserves steadily, while making regular shipments.

Two years ago H. Barkdoll, superintendent of the Old Dominion Copper Mining & Smelting Co., at Globe, and his associates, acquired the Wenden Copper mine, sank a shaft 200 ft. deep, shipped ore and then closed. Adjoining the Wenden are the Conrad claims, which were purchased by El Paso people who organized the Wenden King Mining Co. Considerable money was expended without much to show for the expenditure, and the enterprise came to grief. Activity lagged again, until recently a rather remarkable showing was made in the Little Giant mine. Here two lessees had stoped out a small surface-shoot of high-grade copper ore, ranging from 2 to 15 in. wide. At 35 ft. this gave out, but the new owners acquired a lease and option and continued sinking. At 75 ft. the vein suddenly widened to about two feet, and was followed for about 70 ft., yielding ore assaying from 15 to 20% copper. Sinking was resumed and the ore improved in value. A new level at 125 ft., driven for over 100 ft., revealed excellent ore, in some places being 40 in. wide. About 200 tons of ore was shipped from development work alone, which returned more than $50 per ton net. This new development has

been widely advertised and a number of new companies and lessees are entering the district.

GEOLOGY. The Cunningham pass country is worn down to the old gneiss or schist basement of pre-Paleozoic age. The schist is apparently derived mostly, if not exclusively, from intrusive rocks. Acid and semi-acid rocks, like biotite-gneiss and granite, prevail. The schist strikes N.60°E. and dips 25 to 30° to the north-west. Contorted and folded areas interrupt the uniformity. Paleozoic strata do not appear within five miles of Cunningham pass. The schistose complex has been invaded by intrusives. Two of these are prominent in the mineralized area and have probably influenced the ore deposition. They are: A granitic intrusion of the quartz-monzonite type, sending out numerous pegmatitic and aplitic dikes; and a semi-basic to basic intrusive, ranging from coarse hornblende-diorite to dense porphyritic dikes, resembling diabase. The latter strike generally north-west, while the pegmatite dikes lie in all directions and are irregular in outline, forming a network of dikes, sills, and penetrations in the schist. Both systems of intrusives are cut by the veins and sometimes are distinctly displaced.

The most important veins strike about 60 to 70° north-west and dip to the north-east. Flat and steep dips alternate, varying from 30 to 90°. Even reversals of dip have been found at places. Cross-veins striking N. 30°W. are similar to the main-veins in character and mineralization. Others with a course from north to N. 10°W. seem to carry more gold and less copper. Bedded veins with a strike about N.60°E. are ore-bearing, but likely to prove irregular. The chief importance of all the smaller veins is their enriching influence upon the main veins at intersection-points. Enrichment occurs as well in strike-intersections as in dip-crossings.

Composite stringer-veins predominate, usually with one fissure that is likely to persist over considerable distances. From the evidence available the veins must have been re-opened several times, and the principal fissure appears frequently in several displaced sections, joined by a network of stringers, giving the impression that the main mineralization shifted from one branch of an intricate fracture-system to another abruptly. The dislocating fractures had a course about N.30°E.

The mineralization indicates two distinct periods. The principal gangue of one period of mineralization is quartz, while the other period is characterized by iron, principally as hematite. Both are associated with copper and gold. The strong influence exerted upon the veins by the pegmatite dikes leads me to consider the pegmatite as responsible for the acid mineralization. The iron mineralization I attribute to the semi-basic intrusives. Seams and veinlets of hematite are frequent in the pegmatite dikes, from which it appears that the pegmatite antedates the basic mineralization in the veins, and that considerable replacement of quartz by hematite must have taken place. The hematite has been altered to limonite superficially, but not to any large extent. It occurs massive and in its micaceous variety. The latter is considered a more favorable sign of ore. It is probably due to stress and pressure and is coincident with areas of folding and contortion along the veins. These frequently have produced a false secondary schistosity, and often make the veins appear to conform to the schistosity, where they actually do not. Other gangue-minerals found are siderite, dolomite, and ankerite. Of these siderite is the most important and is closely associated with chalcopyrite. Possibly the hematite has been derived from siderite by metamorphism. Apparently post-mineral barite is common; less frequent is calcite, which is probably secondary. The metallization introduced chalcopyrite and pyrite with accessory gold. Silver is found, but seldom exceeds two ounces per ton, while the gold ranges from $2 to over $50 per ton. The copper has undergone considerable secondary concentration. Chalcocite, cuprite, and malachite are the principal products, while native copper, azurite, and chrysocolla are rarer. The ore generally assays higher than would be judged by its appearance, owing to a penetration of the hematite gangue by cuprite. Exceptional cuprite is found in perfect transparent crystals, accompanied by velvety malachite. The primary chalcopyrite is very pure and usually greatly in excess of the accompanying pyrite.

The orebodies are roughly lenticular, and vary from stringers to about four feet in width. A series of lenses, joined by narrow stringers, has produced a maximum stoping-length of 450 ft., and about the same proven depth in the Critic mine, the most extensively explored property in the district. The Bullard has an ore-zone about 150 ft. long. Favorable places for ore are folded areas, pegmatite-contacts, and the vicinity of basic intrusives. Intersection-zones increase the grade as well as the quantity of the ore.

The average grade of ore shipped from the district in the past was about 18 to 20% copper with about $10 gold per ton. Chalcocite-stringers only a few inches wide are mined, and on being followed they will widen suddenly to several feet of solid ore and then contract again. While careful sorting is required where the vein is narrow, the ore breaks remarkably clean in the bigger shoots. The number of men employed is small. A mine employing 10 men and shipping 200 tons per month should make a good profit, as the net smelter returns are from $50 to $70 per ton. The haul to Wenden costs about $4.50 per ton by team, but is now being done for less by trucks. The roads are fairly good and the grades not heavy. The Jerome scale of wages prevails, but labor is not very satisfactory, because many people dislike the hardships of the desert. The Bullard has shipped over 100 tons per month, working only two to three men, and the same ratio would be possible in most mines, if they were properly opened and employed power drills. The ore commands a ready market on account of its self-fluxing quality. The Clarkdale, Humboldt, Hayden, Sasco, and Douglas smelters have been receiving ore from the district. Cunningham pass is one of the few 'poor man's' copper districts in Arizona.

CREOSOTE has advanced to $2.10 per pound. The demand is active.

Hoisting With Steel Cables

By ERNEST LEVY

Ropes generally break within the lower 150 ft., and nearly always within the lowest 50, especially when the hoisting is done chiefly from the lowest level. This is due mainly to two causes, torsion and vibration.

1. On raising the load the rope twists, and the shorter the loose part becomes the greater is the stress on the rope, owing to the amount of twist having an increasingly shorter length over which to be distributed, hence, when the rope is wound up the torsional stress is greatest.

2. When raising, vibrations are caused to run down the rope; these on reaching the capping become reversed and run up the rope, and in places synchronize with those coming down; at these points of synchronization the strain is most severe. These points are situated within the lowest 150 ft., because at this distance the upward-going vibrations have diminished and died. Hence, the lower 150 ft. has become weakened; in cases, therefore, where the bulk of the hoisting is done from the lowest level it is not advisable to change the rope, end for end, as such procedure would bring the weakened part of the rope into that position which requires the greatest strength.

Another point of great strain is the two feet just off and immediately adjoining the drum, because here the rope has little room for movement, or for disposing itself to strain when the load is started from rest.

Another point of great wastage of life is that part of the rope which touches the sheave-wheel when the cage is at rest, and when the cage hangs freely and does not stand on the chairs, in which event the weight is off the sheave except in very deep shafts, where the weight of rope is a large factor.

The best method for prolonging the life of the rope is to cut from the lower end a length two or three feet in excess of the length of the arc of contact of the rope on the sheave-wheel when the cage hangs freely. This brings the two upper positions of weakness to new places where the strains on them will not be so great, and at the same time the better preserved parts take their places. Rapid hoisting, such as is usual in large coal mines and in the Rand mines, necessitates cutting off the cable every four or six months. One wire broken here and there is not a serious matter, but when several are broken in the same neighborhood the rope is dangerous.

The following directions to the master-mechanic are useful:

1. A weekly examination should be made of all ropes, cages, brakes, clutches, and sheaves, connected with hoisting appliances for raising or lowering men, and a test of the cage-dogs made.

2. The draw-bolt and pin attaching the cage to the rope should be annealed at least once every six months. When the cages are changed it is advisable to have the draw-bolt annealed.

3. Ropes should be greased at least once every month.

4. Ropes should be re-clamped at least once every six months, a minimum of six feet of the rope being cut off each time. The portion cut off must be carefully examined, both as to the exterior and the interior, for corrosion and breaks.

5. Ropes should be discarded either when the number of broken wires in one 'lay' exceeds six, or when the wires on the crown of the strands are worn to less than 65% of their original diameter, or when they show marked signs of corrosion, provided, however, that when such broken wires are reduced by wear more than 30% in cross-section, the number of breaks in any lay of the rope shall not exceed three. In any case, ropes should not be used for more than three years unless a piece cut from the clamping end has been tested by actual breaking-test under supervision of a competent authority.

6. Ropes should be securely fastened to the drums and, when in use, should never be fully unwound; at least one full turn must always remain on the drum.

The 72 outside wires of the rope come to the surface once in every complete turn in the rope's construction, or in every 'lay,' as it is technically termed. With respect to external wear, the places in the rope that should be specially watched are those where the contact with the sheaves or guide-pulley occurs at acceleration or retardation periods of the hoist. These places are also likely to suffer more than others from internal wear, except perhaps that portion of the rope near the cage, which, although generally subjected to no wear from rubbing, yet is exposed to a corrosive effect as well as to the bending and shock stresses. In addition to these positions, attention must be directed also to that part of the rope which lies between the drum and the sheave when the load is at the bottom of the shaft, as also to those parts of the rope which come in contact with the flanges of the drum.

Records of results of all the above directions should be kept either on regular forms or in a book provided for the purpose.

Hoist-men should be warned that:

1. Any defects should be reported immediately to the superintendent, master-mechanic, or other person in charge of the works at the time.

2. Every morning, before hoisting or lowering men, each cage must be run a complete trip up and down the shaft, with a view to making sure that everything is in good working condition.

3. The night-shift man should be required to make an examination daily of all parts of the hoist and to pay particular attention to the controller, brakes, clutches, and ropes. The results of such examination should be recorded on the form provided therefor, and placed on file at the mine office.

4. After every re-clamping of the rope, every rope so treated should be run for at least four trips under full load, before being used for lowering or hoisting men.

5. When a new hoisting-rope is put into use, it should be run for at least 10 trips under full load before being used for lowering or hoisting men.

Aluminum in Germany

A hyphenated Spaniard, by the name of Rodolfo Goetz Philippi, writing for the 'Revista Minera Metalúrgica y de Ingeniería,' of Madrid, professedly knows much concerning the detail of aluminum production in Germany at the present time. He affirms that the Neuhausen concern produced 10,000 metric tons of aluminum last year, using ores derived for the most part from the Austrian bauxite mines. These deposits are inferior in grade to those of France and Spain, but the German metallurgists are said to have so far perfected the process of extraction that large quantities of silica in the bath no longer entail the difficulties that were formerly experienced from an excess of that ingredient. The Neuhausen works are utilizing 80,000 hp. in the form of hydro-electric energy, and the house of Giulini Brothers is constructing a new aluminum plant in Bavaria on the river Inn, where a hydro-electric installation developing 50,000 hp. is being erected. This concern is now producing metal assaying 99.75% pure as tapped from the furnaces. Mr. Philippi also states that the Neuhausen works produce aluminum by means of the Moscicki process which involves the recovery of fixed nitrogen as aluminum nitride in the refining of the bauxite. This is leached, and ammonia is recovered from the liquor, while the alumina is precipitated. The details given are not sufficient to show how this differs from the Serpek process. It is evident, however, that the Germans are carrying the principles of conservation to a high degree in this industry. They are not missing so valuable an opportunity as is presented in the refining of bauxite for utilizing coal slack in order to extract the fixed nitrogen evolved with producer gas made from such cheap fuel. So far this opportunity has been neglected in the United States, although we are hard-pressed for fixed nitrogen and the bauxite of the Southern States is nearly all produced within a few miles of coal mines where similar processes might be utilized. The fact that the Germans are able to employ low-grade bauxite is significant also. The United States has recklessly allowed too many of its trained metallurgists and chemists to go to the firing line instead of keeping them where they can do a higher good through promoting technical advance for the more effective conduct of the War. Germany seems to have been far-sighted in this regard, and it behooves us to attend with equal care to such vital problems. We are inclined to think that the resources of Germany were fully known before the War, but the letter on aluminum in Germany, cited above, gives an account of new discoveries of aluminum ores, thereby greatly augmenting the supply. The deposits recently found are in Alta Hesse, and consist of nodules in the basaltic flows in the Vogelgebirge, the Spessart, and other mountainous areas containing similar rocks. The secondary hydro-aluminous silicates are so abundant in these lavas as to admit of crushing the rock and floating out a product rich enough in aluminum to serve as an ore. The alteration products formed in the basalt are said to exist chiefly as pisolitic nodules, varying from the size of peas to that of melons, while in some cases the change has progressed so far as to leave a mere skeleton of the original rock. The Austrian deposits are said to show a developed tonnage at the end of 1917 of not less than 19,000,000 tons, having the following analyses:

	High-grade, %	Low-grade, %
Al_2O_3	65.50	53.40
SiO_2	0.80	1.54
Fe_2O_3	20.34	30.80
Ti_2O	3.07	2.00
Moisture	11.62	12.00

The lateritic deposits of bauxite worked at Giessen, Gruenberg, Lich, and Gelnhausen contain from 48 to 52% Al_2O_3, and 26 to 34% Fe_2O_3 for the reddish colored ores, and from 57 to 74% Al_2O_3 with about 8% Fe_2O_3 for the white product. We must credit Mr. Philippi with having commented approvingly upon the foresight of the American Aluminum Co. in securing a preponderating interest in the bauxite mines of Dutch Guiana. The same company is working the deposits on Canje creek in the Berbice river district of British Guiana. Similar deposits are reported from many points in Venezuela and from the outer edges of the great bowl of the valley of the Amazon, particularly in Colombia and Ecuador.

Solder containing practically no tin is reported to have been discovered by the Germans. Tin there is scarce because none is mined in Germany and none can be imported. So, to provide a substitute, cadmium was tried first, large quantities of this metal being found in Germany. An excellent solder was made from 80% lead, 10% cadmium, and only 10% tin. This, however, could not be used for making and sealing cans for foods, as the lead in contact with fruit acids produces poisonous salts. Bismuth, another metal found in Germany, was then tried. This, with cadmium and some other metals not revealed, formed a solder which is reported to be non-poisonous. It is almost free from tin. Germany's tin problem must be serious, for a recent Government decree has ordered the confiscation of the tin tops of all beer rings and stems. Even the church bells have been appropriated to a large extent for their metal content.

The tungsten deposits of Essexvale, Southern Rhodesia are producing ore, thus far obtained from 'rubble' or detritus on the surface. The sources of the tungsten minerals, wolframite and scheelite, have not been found. The granite rocks are cut by greisen zones, and typical greisen minerals, including quartz, fluorite, and topaz, are present; there has also been some mineralization of the rock, with deposition of sulphides.

The State of New South Wales, Australia, produces considerable molybdenite. The Kingsgate mine in the north-central region, contains both bismuth and molybdenum. A recent yield from 101 tons of ore was 3804 lb. Bi_2S_3 ad 1297 lb. of MoS_2 concentrates.

The Basic Principle of Concrete Mixes

By DUFF A. ABRAMS

It is commonly stated that concrete is composed of a mixture of cement, sand, and pebbles or crushed stones. This conception of concrete overlooks one essential element of the mixture; namely, water. An exact statement of the ingredients of concrete would be: Cement, aggregate, and water. The last-named material has not yet received proper consideration in tests of concrete or in specifications for concrete work.

Early users of concrete centred their entire attention on the quality of the cement, and practically disregarded the characteristics of the other ingredients. During the past dozen years some attention has been given to the importance of the aggregate, but it is only recently that we have learned that the water also requires consideration.

Tests made of the effect of size and grading of aggregates have shown that the reason why concrete of higher strength and durability can be produced from well-graded aggregate as compared with a poorly-graded aggregate is that the former can be mixed with less water. If this is not done, no advantage is gained from using a coarse, well-graded aggregate. The following discussion shows that a similar conclusion can now be stated with reference to a rich concrete mixture as compared with a lean one:

While the injurious effects of too much water in concrete are apparent, tests made in this laboratory show that the fundamental part played by water in concrete mixtures has been overlooked in previous discussions of this subject. The relation mentioned above is emphasized by a series of compression tests of about 1600 six by twelve-inch concrete cylinders made as follows:

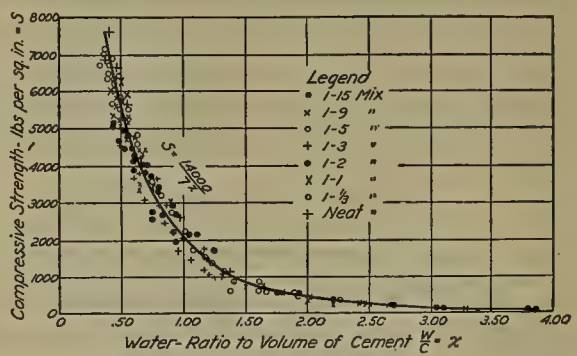
Mixture Cement to Aggregate	Range of sizes of aggregates	Consistence
1 to 15		
1 to 9		
1 to 5	0 to 14-mesh sieve	7 different consistences for each mix and aggregate
1 to 3	0 to 4-mesh sieve	
1 to 3	0 to 1¾-in.	
1 to 3	0 to 1½-in.	
1 to 1	0 to 2-in.	
1 to ⅓		
Neat		

The mixtures used covered a wide range, as did also the grading of aggregate and consistence. The aggregates consisted of two sizes of sand and mixtures of sand and pebbles graded to the sizes shown. The mixture is expressed in terms of volumes of dry cement and aggregate, regardless of grading; that is, a 1:5 mix is made of 1 cu. ft. cement (1 sack) and 5 cu. ft. of aggregate as used, whether a sand or a coarse concrete mixture.

*Abstract from 'Concrete Highway Magazine.'

This series gives valuable information on the effect of changing the quantity of cement, the size of the aggregate, and the quantity of water. The effect of many different combinations of these variables can be studied. One set of relations gives the effect of amount of cement using aggregates of different size and grading; another set of relations gives the effect of different quantities of water, varying both mixture and size of aggregate, etc. In all respects these tests bear out the indications of both earlier and later series. These tests are of interest in that they reveal for the first time the true relation between the strength and the proportions of the constituent materials in concrete.

The figure shows the relation between the compressive strength and the water content for the 28-day tests. The water content of the concrete has been expressed in terms of the volume of cement, assuming that the cement weighs 94 lb. per cu. ft. Distinguishing marks are used for each mixture, but no distinction is made between aggregates of different size or different consistences.



RELATION BETWEEN COMPRESSIVE STRENGTH AND WATER CONTENT

When the compressive strength is platted against the water in this way, a smooth curve is obtained, because of the overlapping of the points for different mixtures. Values from dry concretes have been omitted. If these were used we should obtain a series of curves dropping downward and to the left from the curve shown. It is seen at once that the size and grading of the aggregate and the quantity of cement are no longer of any importance except in so far as these factors influence the quantity of water required to produce a workable mixture. This gives us a new conception of the function of the constituent materials entering into a concrete mixture and is the most important fact that has been discovered in the studies of concrete conducted in our laboratory.

The equation of the curve is of the form,

$$S = \frac{A}{B^x} \ldots\ldots (1)$$

where S is the compressive strength of concrete and x is the ratio of the volume of water to the volume of cement in the batch. A and B are constants whose values depend on the quality of the cement used, the age of the concrete, and the curing-conditions.

This equation expresses the law of strength of concrete so far as the proportions of materials are concerned. For given concrete materials the strength depends on only one factor, the ratio of water to cement. Equations that have been proposed for this purpose contain terms which take into account such factors as quantity of cement, proportions of fine and coarse aggregate, voids in aggregate, etc., but they have uniformly omitted the only item that is of importance; that is, the water.

For the conditions of these tests, equation (1) becomes,

$$S = \frac{14000}{7^x} \ldots\ldots (2)$$

The relation given above holds so long as the concrete is not too dry for maximum strength and the aggregate not too coarse for the given quantity of cement; in other words, so long as we have a workable mixture. Other tests made in this laboratory have shown that the character of the aggregate makes little difference so long as it is clean and not structurally deficient. The absorption of the aggregate must be taken into account if comparison is being made of different aggregates. In certain instances a 1:9 mixture is as strong as a 1:2 mixture, depending only on the water content. The strength of the concrete responds to changes in water, regardless of the reason for these changes.

It should not be concluded that these tests indicate that lean mixtures can be substituted for richer ones without limit. We are always limited by the necessity of using sufficient water to secure a workable mixture. So in the case of the grading of aggregates. The workability of the mixture will in all cases dictate the minimum quantity of water that can be used. The reason a rich mixture gives higher strength than a lean one is that a workable concrete can be produced by a quantity of water which gives a lower ratio of water to cement. If an excess of water is used we are simply wasting cement. Rich mixtures and coarse, well-graded aggregates, are as necessary as ever, but we now know just how these factors affect the strength of the concrete.

Practical use may be made of the curve in estimating the relative strength of concretes in which the water content is different for any reason. For example, a concrete mixed with 7.5 gal. of water (1 cu. ft.) to one sack of cement (allowance being made for absorption of aggregate) gave a strength in this series of 2000 lb. per square inch ($x = 1.00$). For $x = 0.80$ (6 gal. of water per sack of cement) we have 3000 lb. per square inch; for $x = 0.75$ (5.6 gal.) 3300 lb. per square inch. Concrete in a 1:4 mixture (same as the usual 1:2:3 mixture with a coarse sand) should be mixed with 5½ to 6 gal. of water per sack of cement. The importance of any method of mixing, handling, placing, and finishing concrete that will permit the work to be done with a minimum of water is at once apparent.

Assaying on the Rand

As a subject for discussion by the Chemical, Metallurgical and Mining Society of South Africa, John Watson and Chris. Toombs contributed notes entitled 'Assay Economics,' from which the following is abstracted:

Litharge, the largest item of cost in assaying, is now made on the Rand. There is a doubt whether this substance is being used for its proper function, that is, as a lead producer for gathering the gold in the charge being fused, also as a flux. Excessive quantities of litharge are used at times. It costs 60 shillings per 100 lb., equal to 14.4 cents per pound.

Sodium carbonate is also made on the Rand. It acts satisfactorily, and costs 12.5 shillings per 100 lb., or 3 cents per pound.

Borax has been found unnecessary if the furnaces are kept in good condition and at a high temperature. The lead button breaks away clean and bright from the slag. Substitution of fluorspar for borax was tried. The melting-point of CaF_2 (1330° C.) is much higher than that of $Na_2B_4O_7$, and the fluorspar often caused the charges to boil over the crucible; therefore it is not suitable. As a flux in reducing gold precipitate it acts well, replacing half of the borax.

Corn-meal is an excellent substitute for charcoal or flour as a reducer.

Crucibles are all made in South Africa. The East Rand Proprietary reports the following results:

Year	Fusions	Crucibles used	Fusions per crucible
1917	204,200	16,280	12.5
1914	203,600	9,300	21.9

Opinions are divided on the use of part cement and part regular powder for cupels. The cement is decidedly economical costing 2 shillings per 100 cupels, or a half-cent each, but frequently the cupels crack.

MINERAL PRODUCTION of Venezuela during 1917 was 30,913 oz. of gold, 42,271 tons of copper ore, 54,072 tons of petroleum, and 20,165 tons of coal. The coal mines are all operated directly by the Government. The entire product was sold within the country at an average price of 24 bolivars ($4.63) per ton at the pit's mouth. The Ministry states that it is collecting data for a new law upon petroleum production, and urges that the present mining law be entirely changed.

WAR-BREADS containing bran have been found to produce secondary acid fermentations that are detrimental to health. To overcome the difficulty it is recommended that the dough be made with lime-water, the yeast being subsequently incorporated with the dough.

NEW YORK

Financial Situation.—A. I. M. E. Affairs.—Telephone and War.

The absence of any depressing war news has doubtless helped to maintain prices and, in some instances, to appreciate values during the past week. Further extensive selling of the two more recent issues of Liberty Bonds has, on the other hand, brought the market price near the low records of the year. The 4s now stand at 94, and the 4¼s at 96. Treasury Certificates of indebtedness at the rate of $750,000,000 are to be issued every two weeks, and will bear interest at 4½%. The fourth Liberty Loan is timed for October; the amount will be $6,000,000,000, according to recent advices; and the rate of interest will be the same as the last issue. The new loan will create a record if forecasts prove reliable, the minimum being nearly $1,000,000,000 more than the British loan of February 1917. The comparative magnitude of the financing of the two countries may be considered from the fact that the British loan was placed 18 months after the previous loan. About the same time has since elapsed without any further call of this sort. The shorter intervals of time between Liberty Bond issues indicates the financial necessities of this Government, also that War expenses are increasing at a prodigious rate. On the other hand, it would seem that the financial necessities have been over-estimated in the past, as indicated by the smallness of the last issue as compared with official forecasts of requirements made previously. Whether the $6,000,000,000 mentioned will be the sum asked for in October is far from certain, but it is evident that a larger call is unlikely.

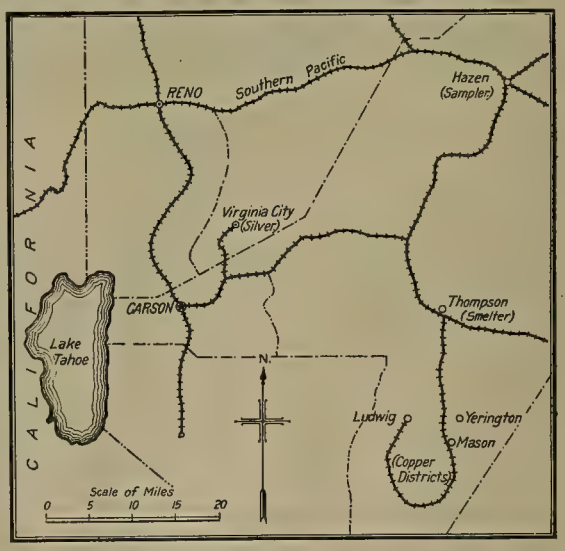
The new officers of the Executive Committee of the New York section of the A. I. M. E. are as follows: Allen H. Rogers, chairman; Forest Rutherford, H. C. Parmelee, vice-chairmen; H. C. Parmelee, treasurer; Walter S. Dickson, secretary; with J. E. Johnson Jr., F. T. Rubidge, and P. G. Spilsbury. The first meeting under the new regime was held at the Machinery Club on June 20, when the advisability of continuing the meetings throughout the summer months was discussed, also the question of holding the meetings elsewhere. It was considered that the committee should call meetings when suitable or feasible. With regard to the place of meetings some spot more central to the homes of the majority of members was considered. Three practical suggestions were made. One was to the effect that the section should take advantage of the fact that a splendid collection of minerals was now housed in the Natural History Museum, and that the meeting should be held there after a dinner in one of the nearby hotels; another was that the Institute should follow the practice of the Mining and Metallurgical Society by holding the meetings at the club at Columbia University; and the third was that the dinner should be held in the vicinity of the Institute headquarters on 39th street, and that the meeting should follow in the Engineering Societies building. Inaccessibility of the Machinery Club after office hours is perhaps responsible for the small number of local members who attend the meetings. In these days of thrift and war economy the price ($1.75) of the dinner is no incentive to a large and representative gathering; but the committee has doubtless found it impossible to efficiently cater at a smaller sum. Members are welcomed to the meetings after the dinner, but the number who have the courage to join the gathering at this stage is so small as to be negligible. The business and technical sessions might well be held in a different room; and the suitability of the United Engineering Societies building will doubtless receive due consideration.

After the last business meeting, members listened to an interesting lecture by H. J. Carroll, of the New York Telephone Co. on 'The Telephone and the World War.' The importance of effective field-telephone systems, especially at critical times, was dealt with realistically, and lantern-slides were shown; the particular adaptation of modern-warfare telephone installations in Mexico, Gallipoli, Italy, France, and Mesopotamia, was described in detail. One of the many modifications of the telephone of vital importance in modern warfare was an instrument, in appearance like a stethescope, for the purpose of detecting the working of enemy tunneling companies in the vicinity of trenches or underground passages.

MASON, NEVADA

Notes on a Lyon County District.

Copper mining has made considerable progress in this district during the past 12 months. Living conditions here



MAP SHOWING LYON COUNTY COPPER DISTRICT, NEVADA

are excellent, and the mines are within a few miles of Yerington and Mason. The former town is the seat of Lyon county and a centre for the agricultural interests in the fertile Mason valley. Skilled labor and miners are in demand.

The Bluestone Mining & Smelting Co., at Mason, is shipping a considerable quantity of oxidized copper ore to the

Thompson smelter; in addition to this it is now regularly shipping flotation concentrate to Utah smelters. The property of this company, formerly owned by J. D. De Lamar, has recently changed hands at the reported figure of $1,500,000, but this has not been officially confirmed. The new owner is the Dominion Reduction Co., with headquarters at Montreal and New York. Maurice W. Summerhayes, late of the Porcupine-Crown at Porcupine, Ontario, has taken over the management at Mason. A new 400-ton flotation mill has recently been completed, and started dressing sulphide ore, which carries an average of 2% copper. Plans provide for duplication of this plant, and it is intended to proceed with this new work almost immediately.

Copper production of the Mason Valley Mines Co. for May was 1,759,728 lb., against 1,058,400, 1,455,200, 1,253,000, and 1,536,600 lb. in the previous months of 1918.

LEADVILLE, COLORADO

Acid Mine Water.—Manganese and Molybdenite.

Generally speaking, mining in this district is unusually quiet. A number of the larger companies, including the Western Mining, Star Consolidated Mining, and Yak M. M. & T., have reduced their working forces. Good miners are scarce, but it is doubtful if more men would be employed if they were available.

The new management (J. G. Hardy in charge) of the Yak Mining, Milling & Tunnel Co., representing the American Smelting & Refining Co., which on January 1 purchased a half interest in the property, is having great difficulty in draining the workings of the Cord and White Cap, the two most productive sections. These workings extend several hundred feet below the tunnel-level and include the largest lead, silver, zinc stopes in the district. The water, which seeps into the Cord and White Cap shafts through extensive deposits of pyrite extending from the Yak to the Moyer and flows into the large open area in these properties, has become strongly acid (SO_4) and corrosive to pumping equipment. The trouble became pronounced early in the spring when surface water greatly augmented the natural flow in the lower Yak workings. The closing of the Moyer mine of the Iron Silver Mining Co., which had maintained large pumping plants in two shafts, also diverted a heavy flow to the Yak, giving the pumps at the Cord and White Cap an unusual burden. The water was more acid than in former years, and destroyed equipment almost as fast as it could be put in. As a result, the lower levels of both Cord and White Cap have been flooded. Additional plant has been secured from other local mines, and rapid progress is now being made in unwatering.

M. L. Buchanan and associates have taken a lease from the Down Town Mines Co. on the A. V. property at the southern limits of the city in California gulch. A steam plant has been put in, and the shaft is being repaired. The A. V. has been idle for several years, but when last active was a large producer of manganiferous-iron.

The May output of the Bohn on Carbonate hill was 700 tons of manganese ore averaging 36% Mn, exceeding the April production by 200 tons. Extraction of silver-bearing iron ore was started last month, and a steady output is being maintained.

Denver men interested in the Weldon property, between the Penrose shaft of the Down Town Mines and the Bohn, recently examined it for re-opening. The Weldon has not been active for nearly 20 years, and was flooded with the other Down Town mines in 1907. Drainage at the Penrose has unwatered it. It is considered to be on the trend of the Bohn manganese shoot, and is surrounded by large ore-bodies under development in the Penrose and Grey Eagle. The possibility of resumption in the near future is one of the brightest factors in the present outlook of Leadville.

Sinking at the Northern shaft of the Dold Mining Co. has been suspended owing to the increased demand for manganese being extracted from the mine. The shaft is 67 ft. below the old bottom level, and has cut a new shoot of high-grade manganese. The lower contact has not been encountered and sinking will be resumed later to accomplish this. The Northern is now producing the largest quantity of manganese since its re-opening two years ago. The plan for establishing the Newell shaft as the hoisting centre of this property is again under consideration.

During May the Climax Molybdenum Co. made two shipments of 25 tons of concentrate each, reported to be worth $200,000. Development at the mine on Bartlett mountain, as reported by the manager, J. H. White, is progressing most favorably. A large and steady tonnage of ore is being extracted through the upper tunnel, where ore-reserves are large. The new White tunnel, 200 ft. lower on the mountain-side, has been advanced to a distance of 500 ft. For its entire length it is in a solid ore. The tunnel will be equipped with electric-haulage system and made the main outlet channel of the enterprise.

A bunk-house for 70 men and three residences have been erected at the mine, and at the mill a boarding-house and several cottages. Another unit will be added to the mill during June, increasing its capacity to 500 tons daily.

Climax is considered to be the future mainstay of Leadville and will draw on the latter for all supplies. Should the Climax field be awarded to Lake county, in the suit pending between Lake and Summit counties, Leadville will certainly derive great benefit.

TORONTO, ONTARIO

Oil Development.—Labor at Porcupine.—Boston Creek.

There is a marked revival of interest in oil and natural gas development, due to the success of the Union Oil & Gas Co.'s operations in Dover township, near Chatham, Ontario. Some time ago oil was struck in a well 3185 ft. deep. This has since been yielding steadily, and recently a second well sunk to 3277 ft. was producing about 400 bbl. daily. Eugene Coste, a well-known oil engineer who has visited the field, states that it presents every indication of persistency. The formation is the Trenton limestone, the same as that which has yielded large quantities of oil in the western Ohio and Indiana fields. This is the first time that oil has been obtained from this formation in Canada, the reason, in Mr. Coste's opinion, being that hitherto drilling has been too shallow to reach the oil strata. With deeper drilling large areas might be opened. Oil operators are preparing to act upon this theory, and many new wells will shortly be put down. A recently-reported find of oil on the Canadian Northern Railway, 70 miles north-west of North Bay, has resulted in the staking of a large number of claims in that vicinity.

The shortage of labor at Porcupine, which is seriously curtailing gold production, has been brought to the attention of the Canadian government. Mine operators hope that action may be taken to relieve the situation.

The annual report of the Dome Mines for the year ended March 31 shows that 247,000 tons of ore was treated during the eight months the mill was in operation, compared with 459,530 tons during the previous year. Total earnings were $1,030,758, and net profit $355,023; compared with $2,171,785 and $952,449 in 1916-'17.

The Hollinger Consolidated is much in need of labor, its staff having lately been considerably reduced. It has declared a dividend of 1%.

Diamond-drilling is under way at the Dome Extension, with the object of ascertaining the direction of the vein system.

A new vein, 8 ft. wide, showing visible gold and telluride, has been found on the Miller Independence at Boston Creek, a little way north of present workings.

CRIPPLE CREEK, COLORADO

General News of the District.

By an agreement made between the Stratton's Cripple Creek Mining & Development Co. (The Stratton estate) and the Findley Mines Co., Basket and Luce, discoverers of the Basket and Luce vein in the American Eagles mine on Bull hill, have resumed work. The royalties from ore marketed will be deposited in escrow pending settlement of a suit between the two companies. The Findley company has brought suit to establish extra-lateral rights to the vein in question, from which the operators named, sub-lessees from W. L. Jamieson of Denver, the original lessee from the Stratton estate, have mined and shipped rich gold ore.

A new vein for the Specimen mine has been cross-cut while driving from the 13th level of the Orpha May shaft to a point under the main shaft of the Specimen mine on Bull hill. The ore is of good shipping grade, but the vein will be left undeveloped until such time as the contract is completed. The Specimen is a Stratton Estate property under lease to the Patterson Bradley Leasing Company.

Development on properties of the United Gold Mines Co. during 1917 totaled 4538 ft., 3130 ft. has been completed in the first four months of 1918. This work was performed by the company or its lessees at its mines on Bull and Ironclad hills and Battle mountain.

The financial statement for 1917 shows disbursements of $30,896, receipts, $17,639, making a loss of $13,257. For the first four months of 1918 disbursements totaled $21,341 and receipts $19,836, making the loss for the present year, $1505.

Two Tenderfoot Hill properties—the Queen Bess and Ella W—are again producing. The former is operated from the 1000-ft. level of the El Paso Gold King mine in Poverty gulch—a depth on the Queen Bess of close to 1500 ft. The ore on the Ella W. is mined near the surface. The Queen Bess ore is of 2-oz. grade; the Ella W. ore of low tenor.

The Jackson or main shaft of the Gold Sovereign Mining & Tunnel Co., on the south slope of Bull hill, has been leased to Evan J. Williams and Ben Olsen, well-known here, who have been operating on the north end of the Cresson property adjoining.

The Victory Gold Mining Co. is mining a good grade of ore on four levels of the Howard shaft of the Mary McKinney company on Gold hill. The same company is also shipping low-grade ore from the Beacon shaft of the Prince Albert group on Beacon hill. Both are leased properties.

LEAD, SOUTH DAKOTA

General Notes From the Black Hills.

Hill City.—H. H. Francis has made arrangements to resume work on his property near Oreville. It is expected that regular shipments of pyrite will be made. Motor-trucks will be employed in carrying the ore from mine to rail, a distance of six miles. The deposit is large and a considerable quantity could be shipped.

The American Tin & Tungsten Co. expects to start work at its tin properties. The Cowboy mine will be further developed and with other properties in the vicinity should supply a steady tonnage to the concentrator.

Keystone.—Regular shipments of copper ore are being made from the Blue Lead mine. Some machinery will be installed to facilitate mine work.

Deadwood.—Work at the Echo has been temporarily suspended awaiting the arrival of electric pumps to handle the water. The hoist and compressor have been moved from the main shaft to the new place of work, where lead-silver ore will be developed. A shaft will be sunk several hundred feet. The ore is high-grade galena, containing considerable silver.

The Golden Crest mine is being unwatered. It is also proposed to start the cyanide plant.

VANCOUVER, BRITISH COLUMBIA

Canadian Mining Institute Western Branch Affairs.

The annual meeting of the Western Branch of the Canadian Mining Institute, held at Vancouver on May 27, was well attended. It was agreed that steps would have to be taken to shake-up the organization. A Council was appointed as follows: J. D. Galloway, Provincial resident engineer of Mineral Survey District No. 2, with headquarters at Hazleton; George Winkler, of Victoria; John Hunt, general superintendent of the Canadian Western Fuel Co., Nanaimo; Thomas Graham, general superintendent of the Canadian Collieries, Cumberland; N. Turnbull, professor of mining in the University of British Columbia; J. G. Davidson, professor of physics in the University; A. B. Clabon, president of the Vancouver Chamber of Mines; E. A. Haggen, editor of the 'Mining and Engineering Journal' of Vancouver; Robert R. Bruce, manager of the Paradise mine, East Kootenay; S. S. Fowler, manager of the New Canadian Metal Co.; Oscar Lachmund, general manager of the Canada Copper Corporation; and E. E. Campbell, superintendent of mines of the Granby Consolidated Mining & Smelting Co. R. H. Stewart, manager of the Sunloch mines was made chairman, and W. Fleet Robertson, Provincial Mineralogist, vice-chairman. For the purpose of keeping informed on problems affecting every branch of mining it was decided that the Council should be given power to appoint sub-committees whose duty it would be to keep in touch with matters affecting the classes of mining work to which they were assigned and in the selection of which the special qualifications of the respective members would be the only consideration. These sub-committees will be as follows: coal, copper-gold, silver, lead and zinc, legislation, and membership. At the meeting three interesting papers were read. One by Frederick Keffer, read by W. M. Brewer, resident engineer for Mineral Survey District No. 6, was entitled 'Flotation Practice at Highland Valley Mines.' Another on 'Petroleum in British Columbia' was by E. A. Haggen; and the third by E. E. Campbell, of Granby Consolidated on 'Mining Operations at Anyox, B. C.'

VICTORIA, BRITISH COLUMBIA

New Mining Regulations.

Three amending acts, directly in the interests of men working in and around mines or smelters, were passed at the recent session of the British Columbia Legislature. These are entitled 'An Act to Amend the Labour Regulation Act,' 'An Act to Amend the Metalliferous Mines Inspection Act,' and 'An Act to Amend the Coal Mines Regulation Act.' The former provides for an eight-hour working day for all men employed "in, or about any coke-oven, smelter, concentrator, or mineral-separation plant." The chief amendment to the Metalliferous Mines Inspection Act is that providing for an eight-hour way to those employed underground, whose day will start when they leave the surface and end when they reach it again, as well as those employed on the surface. These two Acts will become effective on March 31, 1919. The amendment to the Coal Mines Regulation Act gives surface workers at coal mines the eight-hour day from March 31 of next year. New legislation also stipulates that inspectors of metal mines, after making their inspection, shall post the result thereof in some prominent place outside the workings, in order that the miners may be kept in touch with the conditions under which they are working. Another provision is that "every drill used in stoping in any mine where the character of the ground is such that dust is caused" by the work shall be equipped with a water-spray.

ALASKA

Juneau.—As already mentioned in the 'Press' of June 22, owing to the shortage of labor, the Alaska Juneau company is to discontinue using ball-mills and start the pilot stamp-mill. The new mill cannot be run economically on a 1000-ton basis. The present plans are to crush coarse, stamp the ore, and convey it from stamps of the pilot mill to the tube-mills of the new mill, side-stepping the ball-mills.

Skagway.—From a mine 80 miles from here, ore is being profitably carried to the Trail smelter, British Columbia, for reduction. The claims are the Venus group owned by A. M. Dewey of Spokane and a syndicate of Washington and Eastern men. He says they have shipped $200,000 of ore in the last two years. This syndicate is also working a property on Prince of Wales island, from which gold-silver-copper concentrate is shipped to the smelter.

Treadwell.—The Alaska Treadwell company is installing a 2-ton Heroult steel furnace, which has recently arrived from the East. With the addition of this furnace the Treadwell foundry will be the most modern foundry in Alaska. Other plant consists of two cupolas for iron castings, all being served by a traveling electric crane. A large quantity of scrap-iron and steel, accumulation of many years, is available as raw material. The company is making preparations to mill the ore from its molybdenum mine at Shakan. Extensive development has been under way for the past eight months.

ARIZONA

Globe.—The Iron Cap company paid 75c. per share on June 29.

Jerome.—This district seems to be again of more interest, as in the past week or two, three of the active prospects—Verde Combination, Pittsburgh-Jerome, and Calumet and Jerome—have exposed favorable formations. This, with the anticipated starting of the new smelter of the United Verde Extension, and the prospect that Jerome Verde will begin extraction of ore from the Maintop claim, all tend to create the same degree of activity and excitement that prevailed during the boom days of the fall of 1916. Now, however, it is not due to stock-gambling and blind speculation, but is the outcome of carefully following and keeping track of the extensive and systematic development work that has been carried on at the active properties during the past year and a half.

United Verde Extension pays 75c. per share on August 1.

Oatman.—Mine employees in this district are asking for an increase of 50c. per day. The companies offer 15c. The Federal mediator, H. Davies, is investigating conditions, and is to decide at an early date. His decision will be accepted by both sides.

Tombstone.—It is reported that material for the new mill at Douglas for the Phelps-Dodge Corporation is arriving daily, and that tests of the various manganese ores from Tombstone have proved satisfactory.

CALIFORNIA

Atascadero.—A large deposit of manganese has been discovered near this place in San Luis Obispo county. It occurs in serpentine, near a jasper formation. Two or three miles away is some chrome. The manganese is 8 to 10 ft. wide, and the outcrop has been traced 300 ft. It is 5 miles from rail, and a mile of road will have to be constructed. G. W. Cross is to take charge.

French Gulch.—The Crystal Creek power-house of the Hazel Creek Gold Mining Co., 8 miles from French Gulch, was destroyed by fire on June 27. The loss is $30,000. A short circuit was probably the cause. French Gulch and Tower House will be without power and light until the power-house is restored or until connection can be made with the Northern California Power Co. lines at the Gladstone mine.

Kennett.—On June 23 the 1000-ton ore-bins of the Mammoth Copper Co., at the lower end of the gravity train, were destroyed by fire. The loss is given as $10,000, but deliveries of ore from the mine to smelter will be stopped until the new bin under construction is completed.

Redding.—The hull of the American Gold Dredging Co.'s new boat on the Reid Ferry farm, across the river from Redding, will be floated in three weeks. It will take three or four months more to equip the craft. W. C. McBurney is superintendent of construction.

Valley Springs.—Lyons & Ward are shipping a car of chrome per week from this railroad terminus.——McAfee is also shipping some from here. The serpentine belt, in which the ore is found, is only a few miles distant.

Weaverville.—The Lagrange hydraulic mine will have to shut-down early in July on account of shortage of water. This has been the driest season for years.

COLORADO

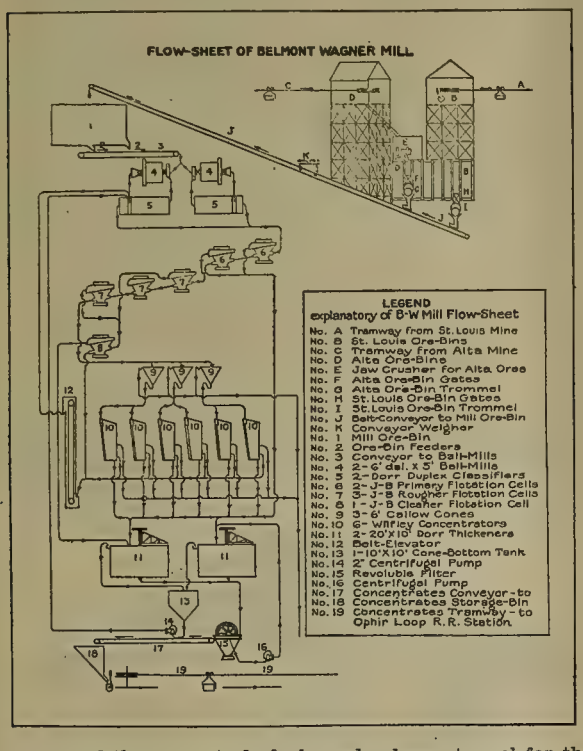
Creede.—The Monon property, three miles from this place, is said to be the largest silver mine in the State. It is owned by the Monon Mining Co., but is being developed by lessees, A. M. Collins and Horace Wheeler. Ore was discovered on November 4, 1917. The shoot so far is 75 ft. long, 28 ft. wide, and assays from 40 to 200 oz. per ton. One hundred cars of ore returned $173,440. The present output is a carload daily. The property was first worked in 1891, and has been leased to various syndicates since.

Georgetown.—The new mill of the Colorado Central Mining Co. is working, dressing silver-lead-zinc ores.

Telluride.—Included in the Tonopah Belmont Development Co. of Nevada report for 1917 is a statement of operations of the Belmont Wagner Mining Co., which has an option agreement with the Wagner Development Mining Co. on its properties in San Miguel and San Juan counties. John M. Fox is superintendent.

The mineral holdings aggregate 124 claims. The property of present greatest importance is known as the Alta group, 4 miles in a south-westerly direction from Telluride. Other properties are in or near Silverton. Prior to acquisition by the Belmont, the Alta vein, a narrow but extremely persistent lode, with a reported past gross production of $1,500,000, had been developed by a series of tunnels aggregating 10,500 ft. in length. The lowest or 5th level followed the vein from surface for 3600 ft., and this, the furthest advanced of the levels, is yet some 500 ft. from the end line of the property. The greatest part of the ore

occurring between No. 5 level, and to a height of 180 ft. above No. 2 level, had been extracted, but the remaining undeveloped vein area between the upper workings and surface is extensive, the vein croppings on Silver mountain rising to a maximum height of 850 ft. above the uppermost workings. The previous development of the St. Louis-Palmyra mine had been confined underground, chiefly to the St. Louis vein. On the St. Louis vein, four levels, aggregating 4500 ft. in length, have been driven, and the lowest of these, No. 4, which followed the vein for 2000 ft. was, roughly, 2500 ft. from the property line. The vein outcrops reach a maximum height of 1650 ft. above No. 4 level, or somewhat over 1000 ft. above the uppermost vein workings. While extensive stoping has been done above the several levels, a considerable reserve tonnage of ore, the present principal value of the mine, remains blocked out, and a large further tonnage is indicated. The former


FLOW-SHEET OF BELMONT WAGNER MILL
LEGEND
explanatory of B-W Mill Flow-Sheet
No. A Tramway from St. Louis Mine
No. B St. Louis Ore-Bins
No. C Tramway fm Alta Mine
No. D Alta Ore-Bins
No. E Jaw Crusher for Alta Ores
No. F Alta Ore-Bin Gates
No. G Alta Ore-Bin Trommel
No. H St. Louis Ore-Bin Gates
No. I St. Louis Ore-Bin Trommel
No. J Belt-Conveyor to Mill Ore-Bin
No. K Conveyor Weigher
No. 1 Mill Ore-Bin
No. 2 Ore-Bin Feeders
No. 3 Conveyor to Ball-Mills
No. 4 2-6' dal. x 5' Ball-Mills
No. 5 2-Dorr Duplex Classifiers
No. 6 2-J-B Primary Flotation Cells
No. 7 3-J-B Rougher Flotation Cells
No. 8 1-J-B Cleaner Flotation Cell
No. 9 3-6' Callow Cones
No. 10 6-Wilfley Concentrators
No. 11 2-20'x10' Dorr Thickeners
No. 12 Belt-Elevator
No. 13 1-10'X10' Cone-Bottom Tank
No. 14 2" Centrifugal Pump
No. 15 Revoluble Pitcer
No. 16 Centrifugal Pump
No. 17 Concentrates Conveyer-to
No. 18 Concentrates Storage-Bin
No. 19 Concentrates Tramway-to Ophir Loop R.R. Station

owners of the property had planned a lower tunnel for the extraction of ore below the lowest workings of the St. Louis and Alta veins, and this, the Blackhawk tunnel, had been started—from a point on the level of the upper floor of the old mill, and 400 ft. below the lowest vein workings—and had been driven 600 ft. For the deep development of the St. Louis vein 4400 ft. of further tunnel work is necessary, and 8000 ft. of still further work will be necessary to develop the other promising veins at this horizon. The early resumption of the driving of this Blackhawk tunnel was decided upon. George H. Garrey, consulting geologist, in a report dated August 1, 1917, summarizes the ore tonnages and values as follows: In the St. Louis vein, 90,987 tons of 'positive' ore, 43,947 tons of 'very probable' ore, 21,431 tons of 'probable' ore, 81,240 tons of 'possibly-indicated' ore, a total of 237,786 tons, of an average value of $10.96 per ton, and a gross value of $2,603,131. In the Alta vein, below the 5th Alta level, 13,604 tons of 'positive' ore, 34,010 tons of 'probable' ore, and 20,406 tons of 'possibly-indicated' ore, or a total of 68,020 tons averaging $11.13, and a gross value of $757,063. In the minor blocks of ore in the Alta vein between No. 5 and 1 levels, 4308 tons valued at $11.13, and a gross value of $47,948. The total reserves in the St. Louis and Alta veins, of all classes, are 310,114 tons averaging $10.99 per ton, and $3,408,142 gross. All values are calculated with gold at $20, silver at 70c., lead at 5c., and copper at 20c. In addition to reserves in place in the veins, there are impounded tailings estimated as follows: 130,000 tons of Alta tailing worth $3.70 per ton, 20,000 tons at $10 per ton, 150,000 tons at $4.54 per ton, and 25,000 tons of St. Louis tailing at $4.50 per ton. For an adequate financial return from the investment, and because the developed ore-reserves seemed to warrant it, the installation of mining and milling equipment for a daily capacity of 300 tons was decided upon for immediate installation. An entirely new mill was considered, but because the best situation was occupied by the existing old mill, and because a part of the old mill building could be made available for housing the new plant, it was decided to remodel the old structure, wrecking parts of it and erecting additions where necessary. New bunk and mess-houses for the men, store-houses and offices, cottages for married employees, etc., were planned.

The process to be used may be followed from the accompaning flow-sheet. Production was expected to start by June 1.

Westcliffe.—The Westcliffe Mining & Milling Co. is erecting a mill at its mine, using the Koering cyaniding process. A start will be made with one Koering recovery-drum, equal to 60-ton capacity. The drum is being made by the Koering company at Salt Lake City, and will be ready for shipment about July 1. A. L. deSpain of Denver is consulting engineer for the Westcliffe company and will be in charge of the installation.

IDAHO

Wardner.—After being a heavy lead and silver producer continuously since 1889, the Last Chance mine has reverted to the Bunker Hill & Sullivan company. This arrangement settles the apex dispute fought in the courts several years ago. By agreement the Federal Mining & Smelting Co., which owned the Last Chance mine, received 28,000 shares of Bunker Hill & Sullivan, and was given the right to work the Last Chance until the end of a period of five months, during which time the company operated at a loss. The Bunker Hill property surrounds the Last Chance. Immediately upon closing down the latter the Bunker Hill offered jobs to all of the old employees.

KANSAS

Baxter Springs.—This district in 1917 produced 10,184 tons of blende and 596 tons of lead, valued at $698,270. The field only entered the producing list of the region last year. There are now four mills in operation, six others nearly complete, and by end of 1918 it is expected that twenty will be dressing ore. Baxter Springs has for many years been the leading agricultural town in the south-east corner of Kansas. Farmers for miles around made it their shipping and trading point. Because of the business thus derived Baxter Springs grew to be a substantial city, gaining in wealth and civic improvements. The discovery of great mineral deposits in the adjacent territory has brought a great transformation in the town, which now has a population of over 7000 people.

MICHIGAN

Houghton.—Production of copper during June will exceed that of May by at least 1,000,000 lb. The most remarkable feature about the whole situation is the fact that the mines are increasing outputs steadily, and are not taking on many new men. Miners are getting more pay, particularly those working on contract. May was a good increase over April, at some mines 25% more, with the number of men at least 25% from normal. The increase is

due to greater labor efficiency. April saw a decided exodus of men. Many of these men moved away because of the prohibition law; many moved as is customary in the spring. The falling-off was noticeable in January, but did not assume large proportions until April. Up to that time the departure of men was normal. The increase in output for May and the still greater increase for June is credited to prohibition in this State. Men now work every shift. Those on contracts have made very high wages. The number of accidents has already been reduced to a low figure.

During May the Seneca Copper Co. sank its shaft 208 ft., which is fast work.

MISSOURI

Joplin.—Production of the region last week was 7044 tons of blende, and 1704 tons of lead. The average value was $51 and $94 per ton, respectively, making a total of $525,585. Missouri contributed $150,040.

MONTANA

Butte.—On June 28, Judge Bourquin of the District Court issued an order releasing all moneys of Butte & Superior tied-up under the order of October 3, 1917, resulting from its suit with Minerals Separation over the flotation patent. Several millions are held, so resumption of dividends is probable.

Corbin.—The Alta mine, 1200 ft. deep, is being unwatered. Water is pumped to surface through the Hewett shaft. A new drift was driven from the shaft under old workings and the water tapped by five diamond-drill holes. Copper ore is expected to be found in place of the great deposit of silver-lead ore mined in the past, said to have yielded many millions of dollars.

Iron Mountain.—On its 400-ft. level the Intermountain Copper company has opened 6 ft. of 12% ore for a length of 200 ft. A. I. Goodell is the new manager.

Jardine.—A shipment of chrome ore from the Jardine Gold M. & M. Co. in Park county recently netted $25,674. Settlement was at the rate of $24.50 per unit.

Kendall.—The Barnes-King company has acquired under lease the Mt. Pleasant gold prospect near its Shannon mine. The new property is considered very promising.

Wickes.—Mt. Washington mine is sending to smelter 75 tons of silver-lead ore daily. Ore is hauled in wagons to Wickes, 2½ miles, where it is shipped on Great Northern cars to the East Helena plant.

NEVADA

Belleville.—The Belleville Tailings Association has finished treating the old mill tailing here in Mineral county and ceased operations. F. C. Beedle was manager.

Goldfield.—Miners employed by the Goldfield Consolidated, Atlanta, and other companies have gone on strike, demanding $4.50 per day, or $4 and a 10% discount on all supplies bought from the company store. The present scale is $3.50, with a discount of 5% on supplies bought. The Silver Pick, Red Hill, and other properties are operating on a $5 scale.

Orizaba.—The Orizaba silver mine in Nye county is now controlled by C. S. Sprague and others, who control the Diamondfield Black Butte company of Goldfield. The mine has yielded ore worth $75,000 from above the 85-ft. level. Large quantities of ore are said to be in the mine and on dumps.

Pioche.—The new 3-compartment shaft at the Prince Consolidated is almost finished, and the hoist and compressor are being erected.

Tonopah.—The weekly production of the district remains around 10,300 tons, valued at $175,000.

The Extension treated 10,464 tons in May, yielding 1003 oz. of gold and 101,182 oz. of silver, giving a profit of $39,727.

Dividends declared are as under:

Company	Amount per share, cents	Total amount	Date
Belmont	10	$150,000	July 1
Jim Butler	7½	128,852	
Tonopah Mining	7½	75,000	July 2

The East Divide Mining Co., composed of Tonopah and Goldfield operators, has purchased the Merced claim east of the Tonopah Divide mine at Gold Mountain. Surface indications are said to be favorable for ore.

OKLAHOMA

Picher.—Production of Oklahoma districts last week was 4975 tons of blende and 1247 tons of lead, valued at $372,245.

A 500-ton mill of the Commonwealth Lead & Zinc Co., valued at $100,000, and out of operation since February, was burned on June 18.

Quapaw.—West of this place water is a hindrance to mining, and a number of mine-owners are co-operating to drain the area. The Muskogee, Imperial, St. Louis, and others are interested.

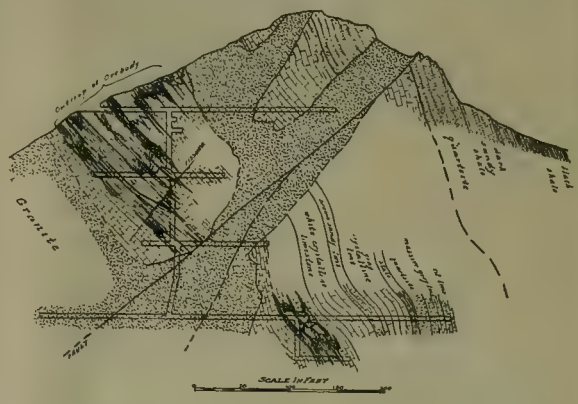
Tar River.—The Maxine company is to let a contract for a 400-ton gas-driven concentrating plant. Twenty-six drill-holes show fine ore at a depth of 205 ft., the face being 35 ft. high. W. C. Miller is superintendent.

TEXAS

Sierra Blanca.—Large pockets of high-grade wulfenite have been found by the Quitman Mining & Milling Co., eight miles west of here. When a process is devised a plant will be erected to dress the ore.

UTAH

Gold Hill.—In 'Economic Geology' for June the Gold Hill district of Tooele county is described by J. F. Kemp and Paul Billingsley. The Gold Hill is the principal mine of the Clifton district, and is shipping copper ore regularly to the



EAST AND WEST CROSS-SECTION OF GOLD HILL MINE, UTAH

smelter at Tooele. It is owned by the Western Utah Copper Co. The relation of the Gold Hill ore deposits to the general geological features of the district appears in the accompanying sketch. A rim of sedimentary rocks, mainly limestone, surrounds an inner basin of granite. To the north, at Dutch mountain, and to the south, at Montezuma peak, this rim rises to 8000 ft. or more. The granite itself forms no eminences, but residual fragments of its sedimentary cover stand up in irregular groups of hills. From the contacts now exposed it is evident that the intrusive top of the granite was nearly flat, and it is further apparent that the

present erosion surface throughout the inner basin nearly coincides with this plane. The more deeply incisive valleys are all in granite, while the hilltops are always sedimentary rock. Gold Hill is the southern termination and highest point of a ridge of such sedimentary formation, which extends as an easterly dipping belt of well-defined limestones, quartzites, and shales from the east flank of Dutch mountain for several miles to the south-east. The ridge is underlain by granite, which appears on both slopes, and it may be regarded as a roof-pendant partly submerged in the intrusive rock. The orebodies of the Gold Hill mine are found within the limestone member of the succession, at a point where it is most intricately cut and enveloped by the intrusive granite. They are not immediately associated with the contacts. Occasionally a contact will exhibit a little cupriferous pyrite intergrown with quartz, calcite, and garnet, but much unprofitable prospecting has demonstrated the small extent and low value of such occurrences. The important mineralization is found entirely within the limestone; and consists, at present, of porous iron oxides, carrying copper, and some lead, in the form of carbonates. No sulphides whatever remain, desert climate and hilltop location combining to carry complete oxidation below any levels yet reached in the mine. In all probability the original mineralization was of pyrite, chalcopyrite, galena, and sphalerite. Thus the Gold Hill ore deposits fall within a familiar and important group, that of the pyritic replacements of limestone near a granite or monzonite contact, a group found at its widest development in the Warren district, Arizona. It is a representative of this group that the Gold Hill orebodies are chiefly of interest, for in occurrence and mineralogy they have few unusual features.

Milford.—The old Lincoln lead mine, 17 miles south-east, is to be drained by a 3700-ft. tunnel. The water will be used for irrigating good land nearby. A. McLease is in charge. A recent shipment of ore averaged 25% zinc, 10% lead, 1% copper, 5 oz. silver, and $1.20 gold per ton.

Park City.—The Daly Mining Co. paid 10c. per share, equal to $15,000, on July 1. This makes $30,000 for 1918, and $3,015,000 to date.

CANADA

British Columbia

Cascade.—The chrome deposits near Laurier on the International boundary have been purchased from R. Wolverton by W. J. Nicholls and others of Spokane. A considerable quantity of ore is said to be available.

Grand Forks.—On August 1 Granby Consolidated pays a 2½% dividend. This is equal to $374,962, making $10,198,895 to date.

Kamloops.—For the further instruction of prospectors, also to induce the location and development of the rarer minerals in the Province, the Hon. Wm. Sloan, Minister of Mines, has authorized the Department of Mines to secure complete exhibits of these minerals and arrange for their display in the centres of the six mineral survey districts into which British Columbia has been divided. The first of these exhibits has been opened by R. W. Thomson, at Kamloops. There will be others at Nanaimo, Prince Rupert, Hazelton, Revelstoke, and Grand Forks.

Kaslo.—Permission has been secured from the Dominion government for the export from Canada to the United States of 5000 tons of manganese ore. The license applies particularly to the Curle property, near Kaslo, which has been opened recently and already has a considerable quantity ready for shipment.

Revelstoke.—The International Mining Convention of the Pacific North-West will be held here in July of this year. The arrangements include unusual and pleasant outings.

PERSONAL

Note: The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

J. K. Turner of Goldfield is here.

H. Foster Bain is expected here this week.

F. W. Bradley spent the week-end at Atolia.

Charles W. Goodale has been in San Francisco this week.

Hennen Jennings received an honorary degree from Harvard University on June 20.

Guy C. Riddell was here last week as metallurgical adviser to the U. S. Tariff Commission.

Forbes Rickard has returned to Denver from the inspection of mines near Sumpter, Oregon.

Edwin E. Chase has gone from Denver to Wickenburg, Arizona, to examine a mining property.

J. S. Diller, of the U. S. Geological Survey, is in California investigating the chrome situation.

Walter S. Brown is now in the research department of the New Jersey Zinc Co. at Pemberton, New Jersey.

A. F. Kuehn has changed his name by legal procedure to Amor Frederick Keene. He is now at New York.

William R. Jones is now manager, at Tavoy, in Burma, for the High Speed Steel Alloys Mining Co., Ltd.

A. L. Queneau, who has seen active service with the French army, is now engaged as metallurgist in England.

William C. Russell has just returned to Denver from an examination of the oil-shale fields of north-western Colorado.

F. L. Ransome, of the U. S. Geological Survey, attended the hearing before the U. S. Tariff Commission in San Francisco.

Earl T. Stannard, manager for the Kennecott Copper Corporation, was married to Miss Jeannette Condon on June 11 at New York.

A. Stansfield, of McGill University, Montreal, is in California investigating electric smelting of iron ore for the British Columbian government.

E. Harms, after sixteen years service with the Cia. Metallurgist de Torreon, Mexico, as manager and metallurgist, has resigned and is now at El Paso, Texas.

Among the experts retained in the Utah Apex v. Utah Consolidated Apex suit are **W. H. Emmons, Waldemar Lindgren, George B. Wilson,** and **W. A. Wilson.**

John Sloan Stewart Jr., who was erecting the lead smelter for the Irtysh Corporation at Ekibastus, in Siberia, passed through San Francisco on his way to Mansfield, Ohio.

J. Volney Lewis, professor at Rutgers College and the University of New Jersey, will devote a considerable part of the summer to professional work in the southern Appalachians.

C. B. Clyne has been engaged as constructing engineer for the Compañia Minera del Mirasol, which is operating the mines for the Cusi Mining Co., at Cusihuiriachic, Chihuahua, Mexico.

H. W. Bell has been appointed Deputy State Oil and Gas Supervisor for the Third district, which includes Santa Barbara and neighboring counties. Mr. Bell has been on the State Mining Bureau staff for some time as inspector and engineer.

W. H. Parker was drowned while swimming the Sun river in Montana on June 22. He was only 27, a graduate of the Montana School of Mines, and had been working as a sampler in the Berkeley mine at Butte. He had been appointed recently safety engineer at the Great Falls Reduction Works of the Anaconda company.

THE METAL MARKET

METAL PRICES

San Francisco, July 2

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	23½
Copper, electrolytic, cents per pound, in small quantities	24⅝
Lead, pig, cents per pound	8.15— 9.15
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

'Antimony in 1916' has just been published by the U. S. Geological Survey. This country produced 4500 tons of 40% ore, valued at $40,580. Imports were 4742 tons of metal in ore and 9874 tons of metal in all forms. See page 899 of the 'Press' of June 29 for the antimony situation in June 1918.

ORE PRICES

July 2

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Magnesite, crude, California, per ton (nominal price)	$7.00—$8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 54%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.25
Pyrite, per unit of sulphur, cents	28
Tungsten, 60% WO_3, California, per unit	$24

Tungsten, as discussed before the U. S. Tariff Commission at San Francisco, will be found on page 5 of this issue.

EASTERN METAL MARKET

(By wire from New York)

July 2.—Copper is unchanged. Lead is quiet but strong. Spelter is inactive though higher.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange.

Date	New York, cents	London, pence
June 26	99.50	48.87
" 27	99.50	48.87
" 28	99.50	48.87
" 29	99.50	48.87
" 30 Sunday		
July 1	99.50	48.87
" 2	99.50	48.87

Average week ending	
May 21	99.50
" 28	99.50
June 4	99.50
" 11	99.50
" 18	99.50
" 25	99.50
July 2	99.50

Monthly averages

	1916	1917	1918
Jan.	56.76	75.14	88.72
Feb.	56.74	77.54	85.79
Mch.	57.89	74.13	88.11
Apr.	64.37	72.51	95.35
May	74.27	74.61	99.50
June	65.04	76.44	99.50
July	63.06	78.92	....
Aug.	66.07	85.40	....
Sept.	68.51	100.73	....
Oct.	67.86	87.38	....
Nov.	71.60	85.97	....
Dec.	75.70	85.97	....

The U. S. government has ceased buying silver for the time being. Large quantities were purchased during the past few months. The Philadelphia Mint is reported to be melting 1,200,000 silver dollars daily. Silver certificates outstanding on June 20 were $392,668,956, compared with $439,960,611 on May 1.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15, 1918. Quotations in cents per pound are as under:

Date	
June 26	23.50
" 27	23.50
" 28	23.50
" 29	23.50
" 30 Sunday	
July 1	23.50
" 2	23.50

Average week ending	
May 21	23.50
" 28	23.50
June 4	23.50
" 11	23.50
" 18	23.50
" 25	23.50
July 2	23.50

Monthly averages

	1916	1917	1918
Jan.	24.30	29.53	23.50
Feb.	26.62	34.57	23.50
Mch.	26.65	36.00	23.50
Apr.	28.02	33.16	23.50
May	29.02	31.69	23.50
June	27.47	32.57	23.50
July	25.66	29.67	....
Aug.	27.03	27.42	....
Sept.	28.28	25.11	....
Oct.	28.50	23.50	....
Nov.	31.95	23.50	....
Dec.	32.89	23.50	....

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6.

Date	
June 26	7.90
" 27	7.90
" 28	7.90
" 29	7.90
" 30 Sunday	
July 1	7.90
" 2	7.90

Average week ending	
May 21	6.92
" 28	7.07
June 4	7.16
" 11	7.31
" 18	7.61
" 25	7.82
July 2	7.90

Monthly averages

	1916	1917	1918
Jan.	5.95	7.64	6.85
Feb.	6.23	9.10	7.07
Mch.	7.26	10.07	7.26
Apr.	7.70	9.38	6.99
May	7.38	10.29	6.88
June	6.88	11.74	7.58
July	6.40	10.93	....
Aug.	6.28	10.75	....
Sept.	6.86	9.07	....
Oct.	7.02	6.97	....
Nov.	7.07	6.38	....
Dec.	7.55	6.49	....

Lead ore, basis of 80% metal, is quoted at $95 per ton at Joplin, Missouri.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
June 26	8.62
" 27	8.75
" 28	8.75
" 29	8.85
" 30 Sunday	
July 1	8.85
" 2	8.85

Average week ending	
May 21	7.41
" 28	7.50
June 4	7.50
" 11	7.56
" 18	7.70
" 25	8.18
July 2	8.78

Monthly averages

	1916	1917	1918
Jan.	18.21	9.75	7.87
Feb.	19.99	10.45	7.97
Mch.	18.40	10.78	7.67
Apr.	18.62	10.20	7.04
May	16.01	9.41	7.29
June	12.85	9.63	7.92
July	9.90	8.98	....
Aug.	9.03	8.58	....
Sept.	9.18	8.33	....
Oct.	9.92	8.32	....
Nov.	11.81	7.76	....
Dec.	11.26	7.84	....

Zinc ore is $5 per ton stronger at Joplin, Missouri, second grades selling at $51.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds:

Date	
June 4	110.00
" 11	110.00
" 18	110.00
" 25	110.00
July 2	120.00

Monthly averages

	1916	1917	1918
Jan.	222.00	81.00	128.06
Feb.	295.00	126.25	118.00
Mch.	219.00	113.75	112.00
Apr.	141.60	114.50	115.00
May	90.00	104.00	110.00
June	74.70	85.50	112.00
July	81.20	102.00	....
Aug.	74.50	115.00	....
Sept.	75.00	112.00	....
Oct.	78.20	102.00	....
Nov.	79.50	102.50	....
Dec.	80.00	117.42	....

Quicksilver, as discussed before the U. S. Tariff Commission, at San Francisco, will be found on page 5 of this issue.

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918
Jan.	41.76	44.10	85.13
Feb.	42.60	51.47	85.00
Mch.	50.50	54.27	85.00
Apr.	51.49	55.63	88.53
May	49.10	63.21	100.01
June	42.07	61.93	....
July	38.37	62.60	....
Aug.	38.88	61.53	....
Sept.	36.66	61.54	....
Oct.	41.10	62.24	....
Nov.	44.12	74.18	....
Dec.	42.55	85.00	....

Eastern Metal Market

New York, June 26.

Quotations, except those for fixed markets, are generally higher than a week ago, and all the markets are strong.

Copper conditions are unchanged at Government prices, with demand on the increase.

Tin is quiet, due to uncertainty as to the effect of the new freight rates.

Lead is strong, but is under control at an agreed maximum price.

Zinc is moderately active, and higher in restricted offerings.

Antimony is quiet and unchanged.

The principal news in the steel market is the result of the meeting at Washington on June 21, on new steel prices for the third quarter. No changes were authorized except on iron ore, which was advanced 45c. per ton to $5.50, effective July 1. Merchant producers of pig-iron hoped for and claimed that they needed an advance on account of increased freight charges, but they were disappointed. With this exception the decisions were satisfactory in the main. The entire industry is on a war-basis, with distribution solely in the hands of the Government.

COPPER

The demand for copper continues large, with that for war-uses on the increase, and less available for strictly domestic use. While the smelter output will probably continue to increase, it is the opinion in the trade that it will be some time, perhaps several months, before this will be reflected in the output at the refineries. The question of price is still prominent. The belief and hope that an increase will be granted not later than August 15 on the present 23.50c. price still holds. Increased freight charges went into effect yesterday, and while the effect of this will not be felt at once, the ultimate result is claimed to be an increased cost of at least 1c. per pound. It is understood that the War Industries Board is about to review the recent decision of the Price-Fixing Committee, but it is hardly probable that this will be finished before the end of July. It has been pointed out that no copper has at any time been sold at less than the maximum price of 23.50c. per pound, which would seem to prove that there is a real scarcity. This is perhaps all the more true when it is realized that grade A zinc has been sold repeatedly at less than the maximum price of 12c. per pound. It is stated that the maximum jobbing-lot price of 24.67½c. per pound for copper has been shaded to 24.50c. Exports of copper in May are reported as 28,889 tons, compared with 49,245 tons in May 1917. The total to June 1, 1918, has been 150,995 tons, against 233,586 tons to June 1, 1917. This is a decrease of 33%.

TIN

The market continues decidedly quiet. One cause is the question of the effect of the new freight rates. This uncertainty has checked trading. Much of the tin now comes by way of the Pacific Coast, and, as most of it is consumed in the East, the question of freight is important. The new rate is reported to be $1.25 per 112 lb. from the Pacific Coast to New York, but this is not yet settled. A rate based on the value of the shipments may prevail, in which case it would be $2.81½. Rumors of a price-fixing policy are not seriously considered, and there is nothing definite regarding this. The spot price is maintained at 92c., New York. A steamer from the Orient, with 750 tons of Banca tin, has reached San Francisco. Already in June over 3000 tons has arrived at Pacific ports and 480 tons at Atlantic ports, and there is 5000 tons estimated to be afloat. The London market has changed little in the week.

LEAD

The market continues strong, and if given full rein it would probably advance to considerably higher levels. Prices, however, are the same as a week ago, or 7.75c., St. Louis, and 7.82½c., New York. The larger producers have mutually agreed, it is understood, on a maximum price of 7.75c., St. Louis, fearing, or perhaps realizing, that otherwise a maximum price will be fixed by the Government. Demand is strong, and this in normal times would create a runaway market, for the supply of lead is not equal to the demand. The requests for deliveries during the summer are reported as calling for probably more lead than can be supplied. According to the New York Metal Exchange the monthly price for lead in May 1917 was 10.91½c. per pound, contrasted with 7.10½c. for May this year.

ZINC

Since last week the market has continued to gain in strength, owing to various causes. On June 25 prime Western was quoted at 8.25c., St. Louis, or 8.50c., New York, an advance of ⅝c. per pound in the week covered by this letter. This is for June and July deliveries. For third quarter the quotation is 8.37½c., St. Louis, or 8.62½c., New York. This situation is due largely to the scarcity of offerings whenever any bids are made, the latter buying but little metal, a situation that has prevailed now for some time. Quotations as high as 8.75c., St. Louis, have been heard of. The entire situation is a strong one from the producer's viewpoint, and promises to continue so for a time at least. All Western smelters report trouble with labor, as well as serious operating conditions due to the excessive heat in the regions lately.

ANTIMONY

Chinese and Japanese grades are quoted at 13 to 13.12½c., New York, duty paid, with 13.25c. asked for small lots. The market is quiet.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, in 50-ton lots, is fixed by the Government at 33c. per pound, while for lots of 15 to 50 tons, 33.10c. is established, with 33.20c. fixed for lots of 1 to 15 tons. Scrap prices are on the same basis.

ORES

Ferro-manganese: The Anaconda Copper Mining Co. expects to begin making ferro-manganese in August. Its output, when at capacity, is expected to reach 30,000 tons per year by the end of 1918.

Iron: As mentioned above, the price of iron ore has been increased 45 cents per ton; following are the prices over a number of years:

Year	Per ton	Year	Per ton
1908	$3.50	1914	$2.85
1909	3.50	1915	2.80
1910	4.00	1916	3.55
1911	3.50	1917	5.05
1912	2.85	1918 (new prices)	5.50
1913	3.40		

Molybdenum and Antimony: There have been no developments reported, and prices are unchanged and nominal at the levels last quoted.

Tungsten: The market is quiet and nominal at $20 to $24 per unit in 60% concentrates, and with off-grades sold at concessions under these levels. Ferro-tungsten is quiet but strong at $2.35 to $2.40 per pound of contained tungsten.

Dividends From Mines, United States and Canada

UNITED STATES

Company and situation	Metal	Shares issued	Par value	Paid in 1918	Total	Latest dividends Date	Amount
Ahmeek, Michigan	copper	200,000	$25.00	$1,200,000	$9,650,000	June 28, 1918	$2.00
Allouez, Michigan	copper	100,000	25.00	450,000	.....	June 26, 1918	1.50
Anaconda, Montana	c.z.s.g.	2,331,250	50.00	9,325,000	147,032,500	Aug. 26, 1918	2.00
American Z. L. & S., United States.	c.l.z.s.g.	96,560	25.00	144,840	.....	May 1, 1918	1.50
Atolia, California	tungsten	100,000	1.00	1,300,000	4,564,500	Feb. 15, 1918	1.00
Arizona, Arizona	copper	1,519,896 £316,530	1.20 7% pfd.	53,000	2,131,000 639,000	May 1, 1918 Mch. 20, 1918	... 0.42
				639,000	20,621,000		
Barnes-King, Montana	gold	400,000	5.00	80,000	180,000	May 15, 1918	0.10
Bingham Mines, Utah	l.s.g.	150,000	10.00	143,000	393,250	July 1, 1918	0.50
Bunker Hill & Sullivan, Idaho	l.s.	327,000	10.00	.....	20,860,500	.....	...
Caledonia, Idaho	l.s.	2,605,000	1.00	234,450	3,376,500	July 5, 1918	0.03
Calumet & Arizona, Arizona	copper	642,462	10.00	2,569,848	38,562,810	June 14, 1918	2.00
Calumet & Hecla, Michigan	copper	100,000	25.00	2,500,000	147,750,000	June 14, 1918	25.00
Center Creek, Missouri	z.l.	100,000	10.00	10,000	660,000	April 1, 1918	0.05
Champion, Michigan	copper	100,000	25.00	640,000	21,994,541	Jan. 7, 1918	6.40
Chief Con., Utah	l.z.s.g.c.	884,223	1.00	176,840	1,013,811	May 6, 1918	1.50
Chino, New Mexico	copper	869,980	5.00	2,174,950	23,358,112	June 29, 1918	1.00
Cerro Gordo, California	l.z.s.	975,000	1.00	.....	175,000	Oct. 15, 1917	0.05
Copper Range, Michigan	copper	394,399	25.00	1,183,198	23,645,819	June 15, 1918	1.50
Con. Interstate-Callahan, Idaho	z.l.s.	464,990	10.00	464,990	6,742,355	June 15, 1918	0.50
Continental Zinc, Missouri	z.l.	22,000	5.00	11,000	396,000	Jan. 2, 1918	0.50
Con. Arizona, Arizona	c.s.g.	1,663,000	5.00	332,600	665,200	June 1, 1918	0.15
Cresson, Colorado	gold	1,220,000	1.00	732,000	6,295,163	June 10, 1918	0.10
Daly, Utah	l.s.g.	150,000	20.00	30,000	3,015,000	July 1, 1918	0.10
Davis-Daly, Montana	copper	600,000	10.00	300,000	300,000	June 29, 1918	0.50
Dragon Con., Utah	c.l.s.g.	1,875,000	1.00	37,500	112,500	April 25, 1918	0.01
Ducktown, Tennessee	copper	198,000	4.80	.....	2,678,702	May, 1917	0.96
Eagle & Blue Bell, Utah	l.c.z.s	893,146	1.00	180,000	1,073,146	June 10, 1918	0.10
East Butte, Montana	copper	411,000	10.00	.....	411,000	Dec. 29, 1917	1.00
Electric Point, Washington	lead	793,500	1.00	23,790	190,320	May 24, 1918	0.03
Elko Prince, Nevada	gold	1,108,566	1.00	110,856	166,284	April, 1918	0.05
Empire, Idaho	copper	1,000,000	1.00	100,000	500,000	July 1, 1918	0.05
Engels, California	copper	1,791,926	1.00	161,273	.....	July 1, 1918	0.01½
Federal, Idaho	l.z.s.	120,000	100.00	210,000	9,240,000	Mch. 15, 1918	1.75
General Development, U. S.	.....	120,000	25.00	240,000	4,823,917	June 1, 1918	1.00
Golden Cycle, Colorado	gold	1,500,000	1.00	135,000	8,313,500	Mch. 10, 1918	0.03
Grand Central, Utah	l.s.	500,000	1.00	25,000	1,759,750	April 12, 1918	0.05
Calumet & Arizona, Arizona	copper	642,480	10.00	.....	35,992,762	.....	...
Hecla, Idaho	l.s.	1,000,000	0.25	50,000	6,955,000	Jan. 20, 1918	0.05
Homestake, South Dakota	gold	251,160	100.00	753,480	41,000,000	June 25, 1918	0.50
Inspiration, Arizona	copper	1,181,967	20.00	4,727,868	20,663,313	July 29, 1918	2.00
Iron Blossom, Utah	l.s.g.	1,000,000	0.10	25,000	3,125,000	April 25, 1918	0.02½
Iron Cap, Arizona	copper	144,872	10.00	289,720	634,197	June 29, 1918	0.75
Isle Royale, Michigan	copper	150,000	25.00	225,000	.....	June 28, 1918	0.50
Jim Butler, Nevada	s.g.	1,718,021	1.00	311,802	1,170,813	July, 1918	0.07
Judge, Utah	l.z.c.s.g.	480,000	1.00	120,000	2,190,000	July 1, 1918	0.12½
Kennecott, Alaska	copper	2,786,879	5.00	5,573,358	.....	June, 1918	1.00
Magma, Arizona	copper	240,000	5.00	240,000	1,544,000	June 29, 1918	0.50
Mary Murphy, Colorado	g.s.l.z.	370,000	5.00	.....	93,106	April, 1916	0.07
Mass Con., Michigan	copper	100,000	25.00	.....	500,000	Aug. 15, 1917	1.00
Miami, Arizona	copper	747,114	5.00	1,767,785	18,100,816	May 15, 1918	1.00
Mohawk, Michigan	copper	100,000	25.00	800,000	.....	July 1, 1918	2.00
Nevada Con., Nevada	copper	1,999,457	5.00	3,509,049	40,280,571	June 29, 1918	0.75
New Idria, California	quicksilver	100,000	5.00	100,000	2,630,000	July 1, 1918	0.50
New Jersey Zinc, New Jersey	zinc	350,000	100.00	.....	.....	June 10, 1918	4.00
North Butte, Montana	c.s.g.	430,000	15.00	322,500	14,559,500	July 29, 1918	0.25
North Star, California	gold	250,000	10.00	50,000	5,387,040	Mch. 29, 1918	0.20
Old Dominion, Arizona	c.s.g.	293,353	25.00	586,706	13,480,891	June 28, 1918	1.00
Ontario, Utah	s.l.	150,000	100.00	.....	15,037,000	July 5, 1918	0.50
Osceola, Michigan	copper	96,150	25.00	576,900	16,987,175	June 28, 1918	2.00
Phelps-Dodge, Ariz., N. Mex., Mex.	c.s.g.	450,000	100.00	6,300,000	72,896,527	June 28, 1918	6.00
Plymouth Con., California	gold	240,000	4.80	57,600	518,400	Jan. 31, 1918	0.24
Portland, Colorado	gold	3,000,000	1.00	180,000	11,137,080	April 20, 1918	0.03
Prince Con., Nevada	l.s.	1,000,000	2.00	.....	575,000	Nov. 1, 1917	0.02½
Quincy, Michigan	copper	110,000	25.00	495,000	26,012,500	June 29, 1918	2.00
Ray Con., Arizona	copper	1,577,179	10.00	2,760,063	18,315,315	June 29, 1918	0.75
Rochester Mines, Nevada	s.g.	2,148,791	1.00	42,976	.....	July 1, 1918	0.02
Shannon, Arizona	copper	300,000	10.00	.....	1,425,000	Nov. 15, 1917	0.25
Shattuck, Arizona	c.l.s.g.	350,000	10.00	525,000	6,912,500	June 30, 1918	0.50
Silver King Con., Utah	l.s.c.g.	700,000	1.00	70,000	1,562,705	April 1, 1918	0.10
St. Joe Lead, Missouri	lead	1,464,780	10.00	1,464,780	12,000,000	June 20, 1918	0.50
Tamarack & Custer, Idaho	l.s.	1,776,500	1.00	106,574	.....	May 20, 1918	0.03
Tennessee Copper, Tennessee	copper and acid	391,498	no par value	391,498	.....	May 15, 1918	1.00
Tintic Standard, Utah	l.s.	1,175,000	0.10	105,730	188,980	June 22, 1918	0.06
Tomboy, Colorado	g.s.	310,000	4.80	31,000	4,037,000	Dec. 31, 1917	0.24
Tonopah Belmont, Nevada	s.g.	1,500,000	1.00	337,500	9,480,559	July 1, 1918	0.10
Tonopah Extension, Nevada	s.g.	1,282,801	1.00	.....	1,912,399	April 2, 1917	0.10
Tonopah Mining, Nevada	s.g.	1,000,000	1.00	150,000	14,725,000	July 2, 1918	0.07½
Union Con., Nevada	s.g.	200,000	1.00	60,000	.....	June 27, 1918	0.05
United Copper, Washington	copper	1,000,000	1.00	.....	150,000	Oct. 15, 1917	0.01
United Eastern, Arizona	gold	1,363,000	1.00	408,900	818,000	June 26, 1918	0.05
U. S. S. R. & M., U. S., Mexico	l.z.c.s.g.	pfd. 486,350 com. 351,115	50.00 50.00	1,702,224 1,755,576	21,476,817 11,190,175	July 15, 1918 July 15, 1918	0.87½ 1.25
United Verde Copper, Arizona	copper	300,000	no par value	4,650,000	50,597,000	May, 1918	1.50
United Verde Extension, Arizona	copper	1,050,000	0.50	1,575,000	.....	Aug. 1, 1918	0.75
Union Con., Nevada	s.g.	200,000	1.00	60,000	.....	May 1, 1918	0.05
Utah Con., Utah	c.l.s.g.	300,000	5.00	150,000	13,917,000	Mch. 25, 1918	0.50
Utah Copper, Utah	copper	1,624,490	10.00	8,122,850	83,893,733	June 29, 1918	2.50
Utah Metal, Utah	l.c.g.s.	691,588	1.00	.....	895,734	Dec. 10, 1917	0.30
Vindicator Con., Colorado	gold	1,500,000	1.00	.....	3,712,500	Oct. 25, 1917	0.03
Wellington Mines, Colorado	l.z.	1,000,000	1.00	100,000	1,750,000	Jan. 1, 1918	0.10
West End, Nevada	s.g.	1,788,486	5.00	178,848	894,243	Mch. 1, 1918	0.10
Yellow Aster, California	gold	1,064,310	1.00	35,000	1,245,789	July 20, 1917	0.05
Yellow Pine, Nevada	z.l.	1,000,000	1.00	120,000	2,130,000	June 15, 1918	0.06
Yukon Gold, Alaska, Cal., Nev.	gold	3,500,000	5.00	87,500	.....	Mch. 30, 1918	0.02½

CANADA

Coniagas, Ontario	silver	800,000	5.00	100,000	8,840,000	Feb. 2, 1918	0.12½
Con. M. & S., British Columbia	l.c.z.s.g.	419,098	25.00	785,805	4,732,168	July 2, 1918	0.62½
Granby Con. M. S. & P., B. C.	c.g.s.	150,004	100.00	1,024,982	10,198,895	Aug. 1, 1918	2.50
Hedley, British Columbia	gold	120,000	10.00	54,000	2,376,000	June 29, 1918	0.15
Hollinger, Ontario	gold	4,920,000	5.00	246,000	8,440,000	June 17, 1918	0.05
Howe Sound, British Columbia	copper	1,984,150	1.00	99,207	99,207	April 15, 1918	0.05
International Nickel, Ontario	n.c. com.	1,673,384	25.00	3,346,768	.....	June 1, 1918	1.00
Kerr Lake, Ontario	silver	600,000	5.00	300,000	7,710,000	June 15, 1918	0.25
McKinley-Darragh, Ontario	silver	2,247,692	1.00	134,861	5,281,083	April 1, 1918	0.03
McIntyre, Ontario	gold	3,610,283	1.00	361,028	900,570	June 15, 1918	0.05
Mining Corp., Ontario	silver	1,660,650	5.00	830,026	3,735,073	June 15, 1918	0.25
Nipissing, Ontario	silver	1,200,000	5.00	600,000	18,030,000	June 20, 1918	0.25
Standard, British Columbia	l.z.s.	2,000,000	1.00	.....	2,700,000	Oct. 15, 1917	0.05
Temiskaming, Ontario	silver	2,500,000	1.00	75,000	2,125,000	Jan. 18, 1918	0.03
Tough-Oakes, Ontario	gold	531,500	5.00	.....	398,625	Jan. 15, 1917	0.12½

Abbreviations: g = gold, s = silver, c = copper, l = lead, z = zinc.

Note: Companies not included in the above list are requested to submit details. Changes in capitalization and new dividends will be entered on receipt of the information. This table will be published quarterly.

INFORMATION FURNISHED BY MANUFACTURERS

COMMERCIAL PARAGRAPHS

The St. Bernard Mining Co., Earlington, Kentucky, has increased its capital from $1,000,000 to $1,500,000 for extensions in operations.

The National Aniline & Chemical Co., Buffalo, is having plans prepared for the construction of a new eight-story extension, about 145 by 225 ft., to cost $40,000.

The Constitutional Lead & Zinc Mining Co., North Century, Missouri, plans to increase the capacity of its milling plant near Joplin from 250 to 500 tons per day. William S. Rogers is president and general manager.

The Rachel Coal Co., Mannington, West Virginia, is planning for the erection of a new power plant and compressor works, to replace the structures recently destroyed by fire. A new ventilation system will also be installed at the mines.

The Midvale Steel & Ordnance Co., Widener Bdg., Philadelphia, Pennsylvania, is planning for the construction of a large new plant at its Nicetown works, to be devoted to the production of large guns and kindred products for Government use.

The Ferguson Steel & Iron Co., 1399 Bailey avenue, Buffalo, New York, will commence work at once on the construction of a new one-story steel addition, about 50 by 200 ft., to its plant on Stanley street. Plans for the structure have been filed.

The Lancaster Minerals & Mining Co., Lancaster, Pennsylvania, has been incorporated with a capital of $500,000 to operate lands containing ores and minerals. Harry B. Cochran, W. Frank Gorrecht, and John F. Smith, Lancaster, are the incorporators.

The Central Smelting & Refining Co., Rider avenue, New York, has commenced the construction of a new smelting plant on Borden avenue, Long Island City, to cost about $50,000. It is proposed to rush the erection and place the works in operation at an early date.

The Ozark Mining & Milling Co., Yellville, Arkansas, recently organized, is planning for the immediate installation of a new 100-ton concentrating mill at its lead and zinc properties. E. T. Stinchcomb, of Lehigh, Oklahoma, is president, and E. E. Scofield, Yelville, is engineer.

The Maryland Chrome Co., Baltimore, Maryland, is considering the installation of a quantity of new machinery and equipment at its chrome properties near Towson, Maryland, to increase the present capacity. The company now has under development about 1000 acres. Frederick A. Dolfield is president.

The Connecticut Zinc Co., operating near Cave City, Arkansas, has acquired about 2000 acres of manganese property along Cave creek, and plans for extensive operations for production and marketing of the material. It is proposed to build a concentrating plant and to install a number of steam-shovels. G. A. Williams is in charge.

Announcement has been made by the management of the **Aetna Chemical Co.** of the acquirement of property comprising about 500 acres at Mount Union, Huntingdon county, Pennsylvania, as a site for the erection of a large new plant to replace the works at Oakdale, recently destroyed by fire. Construction on the new plant will be commenced at once. It has been decided to abandon the site at Oakdale.

The Fairmont By-Products Corporation, Fairmont, West Virginia, is drawing plans for the erection of new coke works, using by-product coke ovens. The initial plant is estimated to cost about $1,500,000. The company was recently incorporated with a capital of $500,000 by O. F. Lough and C. E. Smith.

The Donner Steel Co., Buffalo, New York, operating a plant on Abbott road, is planning for the erection of a large coke works to be devoted exclusively to production for the Government. The plant is near Beacon street, adjacent to the present steel works. A new one-story addition to the steel works is now being erected, to cost about $50,000.

The Commodore Fluorspar Co., Hopkinsville, Kentucky, recently incorporated with a capital of $60,000, is planning for the operation of a plant for the production of fluorspar. An output of about 2000 tons will be made during the present year. The new organization will be under the management of the Southern Mineral Co., E. V. Rawn president.

The Curtis Bay Copper & Iron Works, Curtis Bay, Maryland, is planning for the immediate erection of three new buildings for the manufacture of copper and iron specialties, castings, etc. Plans for the structures, which will be about 60 by 110 ft. each, are now in course of preparation. The company has recently been incorporated with a capital of $1,000,000, the main office being at South Baltimore. William F. Cochrane is chief engineer.

The Princess Iron Corporation, Philadelphia, Pennsylvania, has been organized with a capital of $3,300,000 under the ownership of Frazier & Co., Broad street, Philadelphia. The company will acquire the properties of the Princess Furnace Co., Circle Ore Co., and Callie Mining Co., in the Glen Wilton district, Virginia. The blast-furnace has a daily capacity of 100 tons of high silicon-pig. With two brown hematite iron-ore mines, and over 1400 acres of land in this section, the company will engage in extensive operations, and is considering plans for development.

Meese & Gottfried Co. of San Francisco have issued a descriptive booklet dealing with the Meeseco belt-drive, which consists in the proper application of special resilient idler pulley, admitting of the use of short-centre belt-drives in many cases where speed-chain drives were formerly employed. It saves space, length of belt required, and reduces the width of belt as much as 30%. There are many other advantages, which are fully described with the aid of illustrations. It is a handsome catalogue, and gives instructions and diagrams covering the use of this appliance.

The Sullivan Machinery Co. calls attention to its 'DR-6' mounted water-hammer drill in a bulletin 70-H, which gives details of construction and operation of this equipment, with illustrations showing its application above and below ground.

The Ingersoll-Rand Co. has just issued a bulletin on equipment for sugar factory and refinery service. It is handsomely illustrated.

DRY PLACER MINING

In the desert country of Arizona where no water is available, the Sauerman dragline cableway excavator is making a record in the economic handling of dry placer material.

In all classes of dry excavating, as well as under water, the Sauerman cableways are handling material cheaper than is possible with any other form of excavator for this class of work.

For Placer Mining, either wet or dry, Sauerman excavators afford the ideal means for dredging and handling gravel and dirt.

FOR HANDLING LARGE TONNAGE

It is not economical with many placer properties to equip with expensive dredges for handling material.

Sauerman excavators afford the means of handling materials at an installation cost that is insignificant as compared with that of the gold, platinum and tin dredges.

Let us send you a description of a dry placer property's equipment which affords one of the most difficult types of placer operations where a Sauerman excavator is in successful operation.

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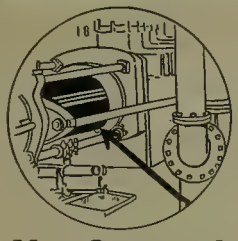
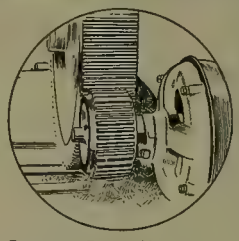
Manufacturers of Cableway Excavators, Power Scrapers and Cableway Accessories.





Use Grease that has the "Vital Element" in it

Graphite is recognized the world over as the ideal lubricant, because of its characteristic way of forming a frictionless veneer over rubbing surfaces.

DIXON'S
Waterproof Graphite Grease

is composed of high-grade mineral stock and selected Flake Graphite. In addition to its excellent lubricating qualities, it is also very adhesive and is a sure rust preventative.

Because of these qualities Dixon's Waterproof Grease is the most economical and efficient grease on the market for pump plungers, heavy gears, wire ropes, chains, heavy rolls and bearings.

Write for Booklet No. 141-W

Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Company

D X N TRADE MARK ESTABLISHED 1827 D X N TRADE MARK

GARRATT JACK HEAD PLUNGER PUMPS

Are Not Affected by
Muddy, Gritty Water

The cylinder has large clearance and the plunger is outside packed at the top. The suction and discharge valves are fitted with bronze taper seats and are easily exchanged by removing bonnets. The Jack Head works altogether on the down stroke; the pump rod is made to weigh just half the amount of pressure exerted on the plunger so that the load is equal and uniform at all times whether on down or up stroke. In this way

Balance Bob is Eliminated

thereby increasing the efficiency and materially reducing cost of installation. These pumps are made with capacities of from 30 to 500 gallons per minute and for elevations up to 600 feet.

W. T. GARRATT & CO.

Established 1850

299 Fremont St. San Francisco, Cal.

"Service" is the cry of '18

We are located here in the center of things, with twenty-five years experience and the largest stock of Mine, Mill and Smelter supplies in the southwest back of us and with an organization and facilities to give you the very best of service.

We are glad to quote prices

Compressors
Machinery
Supplies
Hoists
Drills
Tools

From

Sullivan Machinery Co.
Foos Gas Engine Co.
Dodge Sales & Engineering Co.
The Truax Manufacturing Co.
United States Rubber Co.
Hubbard Shovel Co.

Our new catalog on request

Powell White Star Valves
I T P Carbide Mine Lamps

SAGUARO BRAND P G

PRATT-GILBERT CO.

"ARIZONA'S SUPPLY HOUSE OF QUALITY GOODS"

PHOENIX - - - - ARIZONA

SAGUARO BRAND P G

No. 3 Mill Partly Assembled.
Made in three sizes: 15 to 30, 30 to 60, 80 to 120 tons per 24 hours.

MOST ANY KIND of a MILL

will grind ore for a time, but the **one** that does duty year after year, that **"dosen't eat its head off"** thru repair cost and power cost is the **Denver Quartz Mill.**

It is the **"Ol' Reliable"** in the ore milling world; its record proves it.

Write for literature.

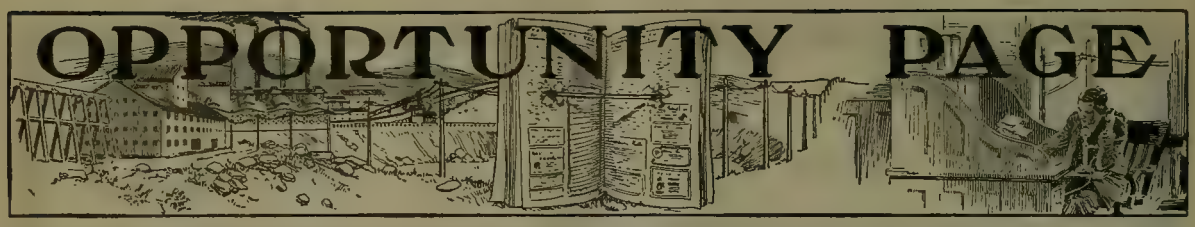
The Denver Quartz Mill & Crusher Co.
216-217 Colorado Bldg., Denver, Colo., U. S. A.

Reasonable first cost, economical operation, dependable service are three big reasons why

B. & B. Aerial Tramways

so thoroughly satisfy their owners. You, too, will be glad when you've installed one. Ask for Catalog 45.

Broderick & Bascom Rope Co.
Saint Louis, Mo.
Branches: New York & Seattle
Factories: St. Louis & Seattle
A10



OPPORTUNITIES

Under this heading announcements may be made of new and second-hand machinery or supplies, for sale or wanted. The cost is five cents per word, including address. One dollar minimum order. Remittances MUST accompany order. Copy must be received by Saturday morning for the following week's issue.

CHROME ORE—Spot cash for chrome ore containing 30% or more chromic oxide. If you control deposits of chrome ore it is your national duty to produce the ore. Send sample with description of deposit. We will analyze such samples and contract for your output. The ore is used in the manufacture of firebrick for steel and metallurgical furnaces and is a war necessity. American Refractories Company, Samuel H. Dolbear, Consulting Engineer, 1412 Merchants National Bank Bdg., San Francisco, California. tf

FOR SALE—On easy terms, a large low-grade gold-silver property consisting of fifteen claims, located in Custer county, Idaho. Immense tonnage developed by over three thousand feet of drifts and cross-cuts. Other minerals, bismuth and wolfram. Write or wire. R. D. Leach, Box 300, Pocatello, Idaho. 7-13

WANTED—A twelve-pipe Johnson-McKay quicksilver retort. Must be reasonably near transportation. Black Butte Quicksilver Mine, Black Butte, Oregon. 7-20

FOR SALE—Thin metal and tin scrap. A substitute for heavier metal scrap as precipitant or smelter flux. Large quantity for immediate delivery. Contracts for large or small quantities. Can load cars to capacity. Price on application. H. D. Staley, 132 Lick Bdg., San Francisco.

WANTED—Hauling contracts anywhere. Seven years experience with auto trucks in mountains and deserts. Can handle any proposition. California Auto Trucking Co., 860 Waller St., San Francisco. Phone Park 5426. tf

FOR SALE—One 4-ft. SENN BATEA AMALGAMATOR, Bul. 41. Has not been unboxed and never used. Sacrifice price. New in San Francisco. Address Excelsior Gold Mines Company, Forest Hill, California. 7-6

FOR SALE—One hundred ton concentrating mill, crusher, rolls, jigs, trommels, Wilfley tables; also 2—9B, 1—7 and 1—5 Cameron sinker pumps. Address Box 668, Salida, Colorado. 7-20

FOR SALE—600 feet high-pressure pipe, double riveted, longitudinally designed, for 330-foot head; also 150 feet same pipe special bents. Pipe new and on railroad. Address P.O. Box 376, Grants Pass, Oregon. 7-20

WANTED—Gas engine, two or three cylinders, vertical preferred; 120 horse-power, for belt drive; California delivery. Address F. L. Sizer, 1006 Hobart Bdg., San Francisco, California. 7-13

FOR SALE—If you want a property that will develop into a great copper mine, with comparatively small outlay of capital, I have it. Address John Slak, Mayer, Arizona. 7-13

FOR SALE—Several gasoline hoists, 2-3-4-6-8 hp.; several belt, steam and electric hoists, water wheels, crushers, rolls and other machinery. U. S. Iron Works, Seattle, Washington. tf

WANTED—Silver or gold property with positive demonstrated tonnage commercial ore. Full particulars will be appreciated. Address Opp. 859, Mining and Scientific Press. tf

90 H. P. GAS ENGINES

Two 90 h.p. Western Distillate Duplicate Engines equipped to burn tops; with friction clutches and Bosch magnetos. Installed one year ago, used 60 days; equal to new in every respect. Immediate delivery central Arizona points. Can furnish either generators or compressors and make complete power plants.

SOUTHWESTERN WRECKING CO.
El Paso, Texas

ORES AND MINES

We are in the market for Western ores and mines of manganese, molybdenum, tungsten, vanadium and chromium. Submit analysis, estimates of quantities available, engineer's reports and maps. Blank forms supplied on application. R. M. R. Co., 629 Citizens National Bank Bdg., Los Angeles, California. tf

SOME TIMELY BARGAINS
IMMEDIATE DELIVERY

TUBE MILLS

2—6 ft. diam. x 10 ft. long, Allis-Chalmers Mills. Herringbone gears. El Oro lining. Designed for motor drive, but can be belted. Can be converted into ball mills by changing to chrome steel lining. In good condition. Offered at an exceptionally low price.

PIPE

6—Miles 4 ″ standard black pipe
3— “ 3 ″ “ “ “
3— “ 2½″ “ “ “
5— “ 2 ″ “ “ “

ALTERNATORS

1—250 K.W. 2300 volt, 3 phase, 60 cycle Westinghouse.
1—50 H.P. 440 volt belted.

ENGINES

60 H.P. type N, Fairbanks-Morse distillate engine, in excellent condition.
90 H.P. Western distillate engine, with friction clutch. Almost new. Used less than 30 days.

Southwestern Wrecking Co.
EL PASO, TEXAS

PLYMOUTH
Gasoline Locomotives

J. D. Fate Company
PLYMOUTH, - OHIO

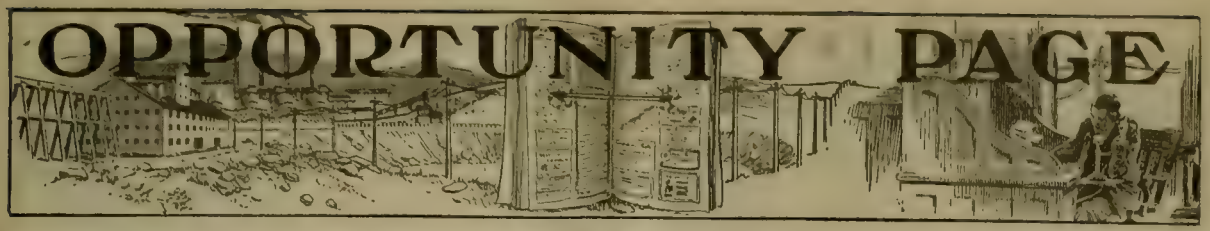
Treatise on Hydraulics--Tenth Edition

By Mansfield Merriman

565 Pages. Fully Illustrated. Price, $4.00 Postpaid.

CONTENTS: Fundamental Data. Hydrostatics. Theoretical Hydraulics. Instruments and Observations. Flow Through Orifices. Flow of Water Over Weirs. Flow of Water Through Tubes. Flow of Water Through Pipes. Flow in Conduits. The Flow of Rivers. Water Supply and Water Power. Dynamic Pressure of Water Wheels. Turbines. Naval Hydromechanics. Pumps and Pumping. Appendix. Mathematical Tables. Hydraulic Tables (in text).

MINING and Scientific PRESS
420 Market Street San Francisco



POSITIONS WANTED

The cost of advertising for positions wanted is 2 cents per word per insertion, including address. Minimum order 50 cents. Replies forwarded without extra charge. Remittances must accompany order. Copy must be received Saturday morning for the following week's issue.

CARPENTER capable of taking charge of mill construction as general foreman or superintendent. Have transit and some technical education. Wages no special object if conditions are right. Address PW 943, Mining and Scientific Press. 7-20

WANTED—Position as mine blacksmith; 20 years experience; done everything from helper to shop foreman; will go anywhere; can give best of references. Address PW 935, Mining and Scientific Press. 7-6

WE CARRY A LARGE STOCK OF TECHNICAL BOOKS
Send for Catalogues
MINING AND SCIENTIFIC PRESS, 420 Market Street, San Francisco

Industrial Engineering Co., Inc.
432-5 ATLAS BLOCK SALT LAKE CITY
Designers and Builders of
BALL MILLS AND CRUSHERS

EFFICIENCY and FUEL ECONOMY in Copper Smelting
PERKINS FURNACE CO., Inc.
Owners of Rights in the
Perkins Non-Reversing, Up-Cast, Self-Cleaning
Regenerative Reverberatory Smelting Furnace
Increases Furnace Capacity 50% Reduces Fuel Cost 50%
The Perkins Furnace Co., Inc.
587 Mills Bldg. San Francisco, Cal., U. S. A.

"CRESCENT" WIRE ROPE
All desirable types and sizes for Power Transmission, Hoisting, Hauling, Conveying, Cableways, Guy Wires, etc. Let us quote.
San Francisco
Rolph Mills Co.
149 California St.
Geo. C. Moon Co.
Wire Rope for all purposes
GARWOOD, NEW JERSEY

POLHEMUS BROS.
GENERAL CONTRACTORS AND BUILDERS
We make a specialty in the installation of power plants, mining, milling and smelting machinery, foundations, buildings and reinforced concrete structures.
We will be pleased to submit estimates or supervise your construction work on a cost plus percentage basis.
Cable: POLHEMUS. Austin, Texas. tf

Complete Cyanide Mill
Hoisting and Surface Plant

We offer for sale the complete 200-ton mining, milling and surface plant and equipment of the NEVADA HILLS MINING COMPANY, at Fairview, Nevada

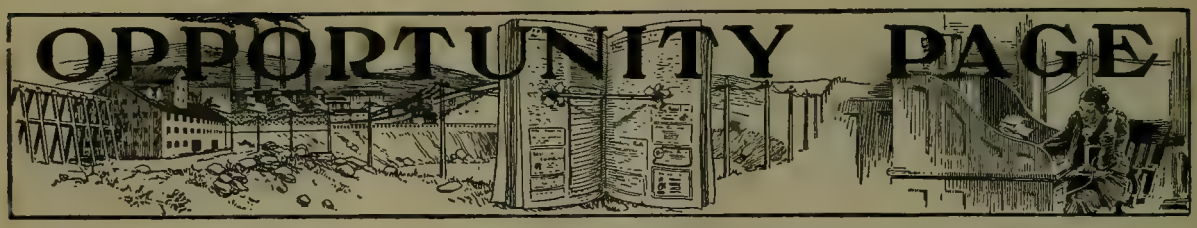
This was considered the most complete plant in the State of Nevada, and briefly stated consists of

Structural Steel Mill Building
Asbestos Protected Metal Covering
Steel Gallows Frame, Skips and Cages
Steel Ore Bin and Air Lifts
150 H.P. Electric Hoist
200 H.P. Electric Compressor Plant
20x12 Blake Crusher
20 Stamps—1200 lbs.
Tube Mills
Concentrating Tables
Akins and Cone Classifiers
Triplex, Duplex and Centrifugal Pumps
Dorr Thickeners and Agitators
32 Redwood Tanks
Refinery complete
Oliver Filters
Slime Conveyor
Air Compressors
Boiler Plant
Perrin Presses, etc.
33 Alternating Current Motors
12 Transformers
Hoist House
Blacksmith and Machine Shop
Transformer House
Storehouse
Boarding House
Office Building and Equipment
Assay Office
14 Cottages

COMPLETE IN EVERY PARTICULAR.

We invite correspondence, and can offer an exceptional proposition to anyone in a position to purchase the plant as it stands. We suggest the use of the telegraph. Address communications to

Nevada Engineering and Supply Company
RENO, NEVADA



POSITIONS AVAILABLE

Announcements in this column are secured through the co-operation of many of the largest mining companies in the United States. Advertisements under this heading will be inserted two times without charge. Additional insertions charged at the rate of 1c. per word, including address.

TEMPORARY FREE REGISTRATION—While present heavy demand continues for well-qualified men in all branches mining, milling, smelting, we will accept, without registration charge, applications for mining or metallurgical engineers, assayers, chemists, etc., who are technical graduates and who would accept salaries of $150 or lower. Desirable positions secured promptly. We have placed fourteen thousand men in positions, at salaries up to $6500 per annum. Established 15 years. Business-Men's Clearing House, Denver, Colorado. tf

WANTED—Mine shift-boss with some knowledge of Spanish. Good climate and living conditions. Salary $175, to be raised to $185 if services are satisfactory. Address PA 940, Mining and Scientific Press. 7-6

WINCHMEN wanted for gold dredging property in South America; can use several good men. Single men acquainted with river dredging in tropical countries preferred. Transportation paid; two years contract; in replying state fully experience and monthly salary expected. Address PA 942, Mining and Scientific Press. 7-20

WANTED—Two millmen to run gas engines and tube mill; $4.25 a shift. Address PA 939, Mining and Scientific Press. 7-6

WANTED—Young engineer of experience to do scout examination work for two or three months; salary $250 a month and expenses. Address PA 945, Mining and Scientific Press. 7-13

WANTED—Experienced assayer and chemist for old established San Francisco office. Partnership eventually possible. Address PA 944, Mining and Scientific Press. 7-13

MINING AND SCIENTIFIC PRESS wants a permanent circulation representative in every mining community in the world. Replies will be held confidential if desired. Address, The Manager, Mining and Scientific Press.

Used Mining Machinery

IMMEDIATE DELIVERY

1—12x20 Hercules Blake Type Crusher.

1—14x24 Hercules Blake Type Crusher.

1—12x16 Golden State Blake Type Crusher.

1—Gates No. 0 Gyratory Crusher.

1—Style B Allis-Chalmers Gyratory Crusher.

1—Radial Drill 3½′ Arm.

2—Vertical 20″ Drill Presses.

1—5x18 Allis-Chalmers Tube Mill.

2—72x16 Return Tubular Boilers.

2—72x16 Return Tubular Boilers with State Certificate.

1—40 H. P. Firebox Boiler.

1—5x5 Allis-Chalmers Ball Mill.

A. H. SIMPSON COMPANY

635 Stevenson St. - - San Francisco

Do You Want { A MAN OR A POSITION IN THE MINING FIELD?

Every line a Company we furnish Men.—A camp where applicants are listed with us. 15 years in this work.

Mine, Mill, Smelter Supts., Foremen, Shift Bosses, Engineers, Assayers, Chemists, Master Mechanics, Electricians, Accountants...

SECURED PROMPTLY — WITHOUT CHARGE

BUSINESS-MEN'S CLEARING HOUSE - DENVER, COLO. U.S.A.

WANTED—We receive numerous calls for qualified mining, civil and mechanical engineers, and executives, commanding salaries of $250 per month and up; no charge for registration; all applications strictly confidential.

PACIFIC AUDIT & SYSTEM COMPANY, Inc.,
Placement Bureau,
604 Mechanics Institute Bdg., 57 Post St., San Francisco

WAR SAVINGS STAMPS DELIVERED TO YOUR HOME

Tear Out—Fill In—Hand Letter-Carrier—or Mail to Post Office

TO THE LOCAL POSTMASTER:—Kindly have letter-carrier deliver to me on _____ (Date) for which I will pay on delivery:

_____ (State number wanted) $5. U. S. WAR-SAVINGS STAMPS at $_____ (See prices below) each

_____ (State number wanted) 25c. U. S. THRIFT STAMPS at 25c. each.

Name _____

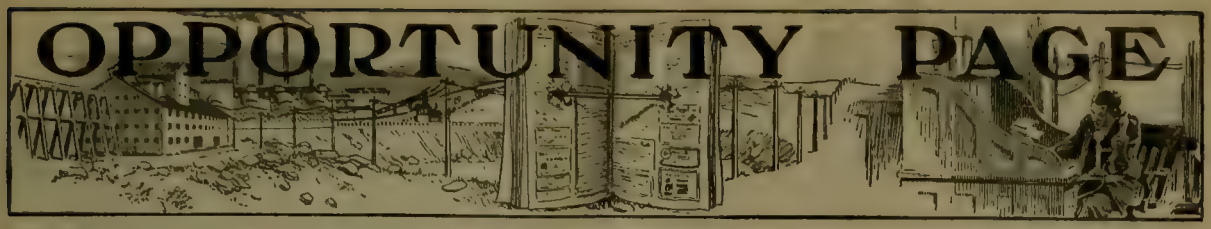
Address _____

W.S.S. WAR SAVINGS STAMPS ISSUED BY THE UNITED STATES GOVERNMENT

W. S. S. COST DURING 1918

April	$4.15	July	$4.18	Oct.	$4.21
May	4.16	Aug.	4.19	Nov.	4.22
June	4.17	Sept.	4.20	Dec.	4.23

W. S. S. WORTH $5.00 JANUARY 1, 1923



General Offices
156-62 Perry St.
New York City

Plants
Fayetteville, N. C.
Collins, Ga.

Pine Flotation Oils

Complete Stock Carried
In Salt Lake City

Georgia Pine Turpentine Co. of New York

S. S. SKELTON, Western Mgr.

P. O. Box 1994 Salt Lake City

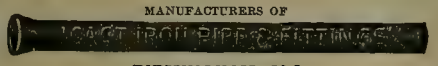
EDGAR JAMISON STEEL CO.
HIGH GRADE STEEL

High Speed Steel | Alloy Steels | Tubing
Tool Steels | Cold Rolled Strip Steel | Spring Steels
Alloy Steel Billets | Steel Specialties Of All Kinds | Welding Materials

77-79 NATOMA STREET, SAN FRANCISCO

HOLLOW CRUCIFORM OCTAGON
DRILL STEEL
ALL SIZES IN STOCK FOR IMMEDIATE DELIVERY
ALSO COMPLETE LINE OF MINE SUPPLIES
CONTINENTAL STEEL & SUPPLY CO., SAN FRANCISCO, CAL.

AMERICAN CAST IRON PIPE COMPANY
MANUFACTURERS OF



BIRMINGHAM, ALA.
SALES OFFICES:
Birmingham, Ala.—Box 908. | Chicago, Ill.—512 1st Nat. Bk. Bldg.
Columbus, Ohio—607 New Hayden Bldg. | Dallas, Tex.—1217 Praetorian Bldg.
Minneapolis, Minn.—712 Plymoth Bldg. | Kansas City, Mo.—716 Scarritt Bldg.
New York City—No. 1 Broadway | San Francisco, Cal.—711 Balboa Bldg.

TESTED AND GUARANTEED
PIPE
For Every Purpose
New Threads and Couplings
Hot Asphaltum Dipped
Second-Hand and New
Screw Casings, Fittings, and Valves
Pacific Pipe Co. (Established 1906) **201 Howard St., San Francisco**

ALADDIN and his wonderful lamp had nothing on us. For instance—you need a piece of machinery—an engine—a motor—a head-frame—*anything*. You wire us. Back goes a wire giving prices and detailed information. Want to know more about this Service? *Write!*

MINES SUPPLY COMPANY
CUNARD BUILDING — SAN FRANCISCO

For Lubrication of Mine Machinery

SECURE a lubrication service for your mine equipment that is exceptionally economical and at the same time highly efficient.

Hoisting Engines
Compressors
Winding Machines
Blower Fans
Crushers
Drills
Motors
Cars
Locomotives

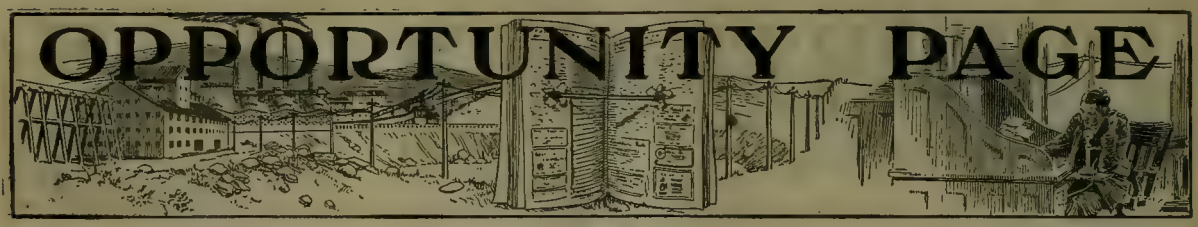
This equipment when lubricated with

ALBANY GREASE

will produce maximum results, operating with cool, easy running bearings—at a minimum cost. We have collected data in detail giving results of comparative lubrication tests on mine equipment which points out the great saving secured with Albany Grease. This data will be sent you on request. You can conduct a test on Albany Grease at our expense. A sufficient quantity of Albany Grease and an Albany Cup will be sent you without charge, upon receipt of your request.

Your dealer sells Albany Grease. If not, order direct.

Albany Lubricating Co.
Adam Cook's Sons, Props.
708-10 Washington Street
New York
Established 1868



$40,000,000 POTASH TAILINGS

We own approximately 8,000,000 tons of Tailings that will average 10% K_2O. They are crushed to minus 100, are located at Colorado Springs, Colo. Lime beds on the property. These tailings are from Cripple Creek ore. A rare opportunity for anyone having a process for obtaining the Potash from Silicates. Will sell outright or lease to responsible parties.

THE MORSE BROS. MACHINERY & SUPPLY CO.
DENVER, COLO. 6-29

BRONZE BUSHINGS

SAN FRANCISCO BRASS FOUNDRY
Brass, Bronze, and Aluminum Castings
48-50 Clementina St., San Francisco F. J. Carroll, Prop.

FRENIER'S SAND PUMP
THE MOST DURABLE FOR
SLIMES, TAILINGS, BATTERY SANDS, Etc.
AGENTS
Allis-Chalmers Co. Stearns-Roger Mfg. Co.
Chicago, Ill Denver Colo.
Harron, Rickard & McCone, San Francisco
Frank R. Perrot, Sydney and Perth, Australia
FRENIER & SON, RUTLAND, Vt.

MINING, MILLING, SMELTING, CHEMICAL EQUIPMENT
THE WORLD'S LARGEST STOCK OF USED EQUIPMENT
MORSE BROS. MCHY. AND SUPPLY CO.
USED MACHINERY
READY FOR IMMEDIATE SHIPMENT AT DENVER, COLO
CABLE ADDRESS

For Better Bookkeeping
LOOSE I-P LEAF
ASK YOUR STATIONER

DREDGES FOR GOLD AND TIN
UNION CONSTRUCTION CO.
604 Mission St., San Francisco, Cal.
NEILL JIGS
UNION CHURN DRILLS
BOLINDER OIL ENGINES
AGENTS FOR
Bucyrus Company

Gyratory Crushers

1—No. 5 Gates. 1—No. 5 Austin.
1—No. 2 Gates. 1—No. 5 Symons.
1—Gates Laboratory.

Jaw Crushers

1—5x30 Blake, Robinson-Rea.
1—11x15 Dodge, C. I. Works.
2—No. 3—7x11 Sampson.
1—13x24 Blake, Allis-Chalmers.
1—13x24 Blake, McFarlane.
3—4½x6 Dodge, McFarlane. "New."
1—No. 4—7x16 Sampson.
1—7x10 Universal.
1—9x15 Blake, Denver Engineering Works.
2—9x15 Blake, Ferrell. 3—7x10 Blake.
1—10x20 Blake, Davis. 1—4x10 Blake, Ferrell.
1—6x6 Denver Quartz. 1—5x10 Blake, McFarlane.
3—13x24 Nickel Steel Crusher Shafts for Blake.
2—10x20 Nickel Steel Crusher Shafts for Blake.
2—9x15 Nickel Steel Crusher Shafts for Blake.

Crushing Rolls

2—12x20 Davis Standard. 1—12x12 Davis Standard.
1—12x20 McFarlane Parallel, New. 1—12x20 Stearns Roger.
1—12x20 Colorado Iron Works.
2—14x27 Davis Standard.
1—14x27 McFarlane Parallel, New.
1—14x27 McFarlane Parallel. 5—16x36 Davis Standard.
1—14x26 Stearns-Roger. 1—16x40 Colorado Iron Works.
2—14x27 McFarlane Horizontal. 1—16x36 Colorado Iron Works.
3—14x36 Allis-Reliance. 1—10x 3 Triplex Sample.
3—14x30 Allis-Reliance.
1— 8x20 Traylor Engineering Works.

Pulverizers and Mills

1—No. 2 Gardner Crusher.
1—3½x5 American Pulverizer.
1—3½ Ft. Huntington Allis-Chalmers.
1—5 Ft. Huntington Allis-Chalmers.
1—13 In. Symons Disc Crusher. 1—5 Ft. Denver Quartz Mill.
1—6 Ft. Huntington Davis. 1—3½ Ft. Denver Quartz Mill.

Ball Mills

4x3 Standard Ball Mill, New. 3x3 Standard Ball Mill, New.
5x4 Standard Ball Mill, New. 3 Ft. x 30 Standard Ball Mill, New.
6x6 Standard Ball Mill, New Lining.
5½x6 Standard Ball Mill, New Lining.
6x8 Standard Ball Mill, New Lining.
6x10 Standard Ball Mill, New Lining.
6x12 Standard Ball Mill, New Lining.
30x21" Standard Laboratory Charge Mill, New.
30x32" Standard Laboratory Charge Mill, New.

Tube Mills

54x12 Colorado Iron Works Tube Mill.
60x14 Colorado Iron Works Silex Lining.
60x15 Abbe Tire Type Silex Lining.
72x12 Allis-Chalmers Silex Lining.
5—72x12 Allis, Either Silex or El Oro, New Lining.
60x24 Davis, Either Silex or El Oro, New Lining.
5—66x16 Davis, Either Silex or El Oro, New Lining.
48x14 Colorado Iron Works, El Oro Lining.

Stamp Mills

6 Stamp, 350 lb. Prospectors Tremain Steam Stamp, Practically New.
80—900 lb. Stamps, Mill Complete.
100—1000 lb. Stamps, Mill Complete.
20—850 lb. Stamps, Mill Complete.
Extra parts for Stamp Mills, All Makes.

Dorr Thickeners

3—33 Ft. Dorr Thickener Mechanisms with Redwood Tanks 12 Ft. Deep.
4—36 Ft. Dorr Thickener Mechanisms with Steel Tanks 12 Ft. Deep.
3—24 Ft. Dorr Thickener Mechanisms with Redwood Tanks 12 Ft. Deep.
2—24 Ft. Dorr Thickener Mechanisms with Wood Tanks 8 Ft. Deep.
2—18 Ft. Dorr Thickener Mechanisms Only.
1—22x8 Ft. Dorr Thickener.
2—18x10 Ft. Dorr Thickeners.

Dorr Agitators

3—Dorr Agitators with 20x20 Ft. Redwood Tanks.
3—Dorr Agitators with 18x15 Ft. Oregon Fir Tanks.
3—Dorr Agitators with 12x10 Ft. 8" Wood Tanks.

Dorr Classifiers

1—Dorr Duplex Classifier in Steel Tank.
2—Dorr Simplex Classifiers in Steel Tank.
1—Dorr Simplex Classifier, Extra Long, in Steel Tank.

THE MORSE BROS. MACHINERY & SUPPLY CO.
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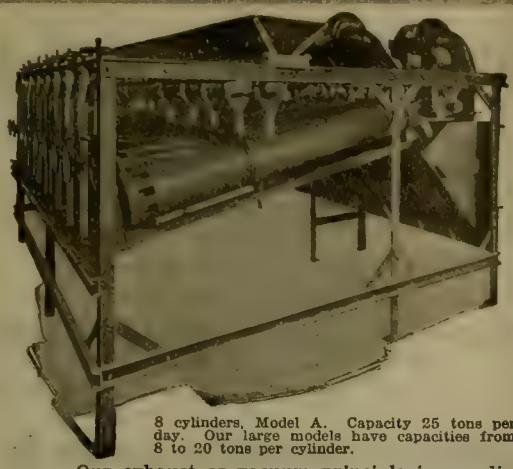

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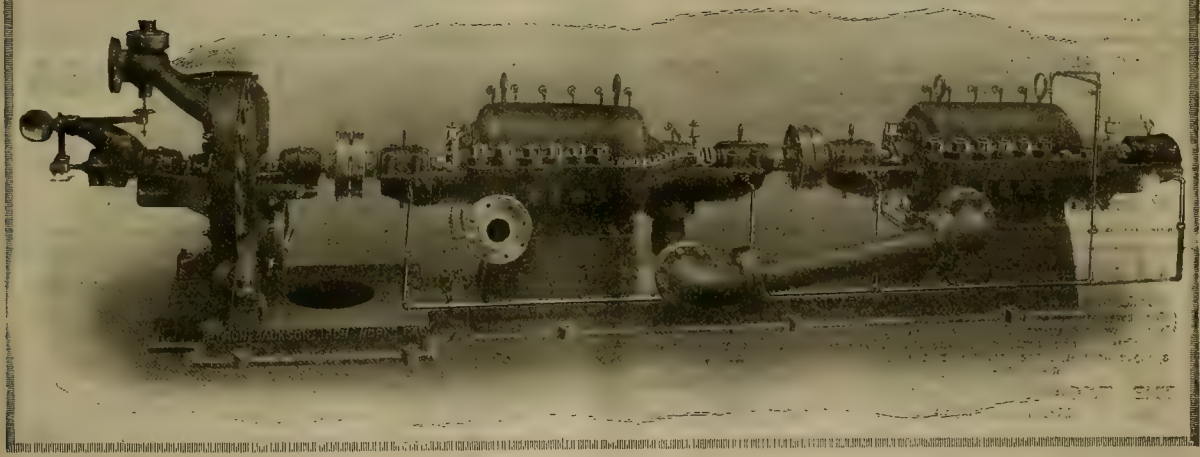

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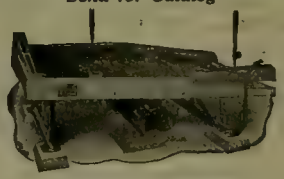

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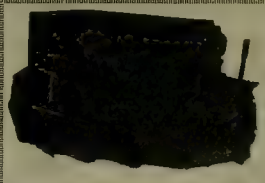

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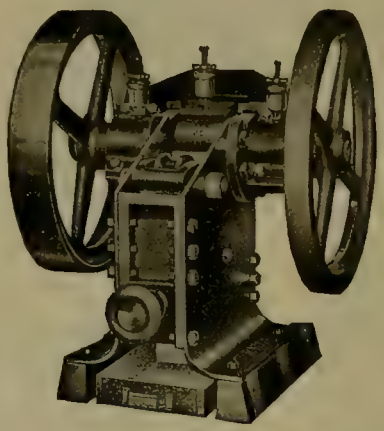

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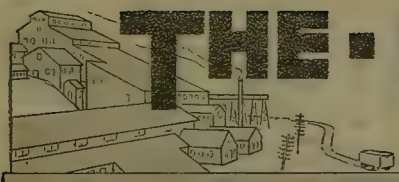

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Bartley Crucible Co., Jonathan
Detroit Graphite Co.
Dixon Crucible Co., Joseph
Hardy, Charles

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Braun Corporation, The

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Powell Co., Wm.
Tay Co., Geo. H.

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Simpson Co., A. H.

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Galigher Machinery Co.
Harron, Rickard & McCone
Justrite Mfg. Co.
Lunkenheimer Co., The
Powell Co., Wm.
Tay Co., Geo. H.

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Magnetic Separators and Pulleys
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Preservatives, Wood
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Hendy Iron Works, Joshua

(Continued on page 61)

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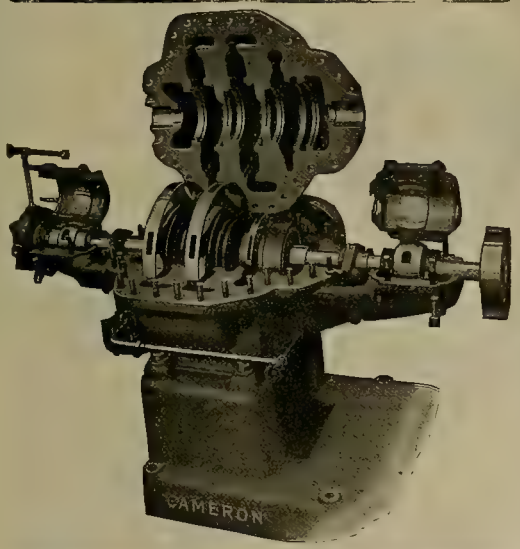

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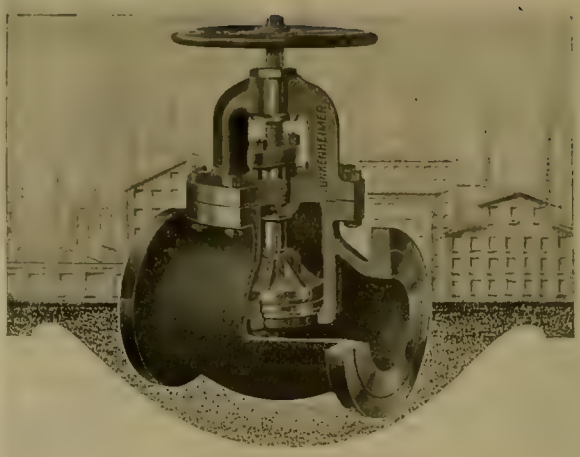

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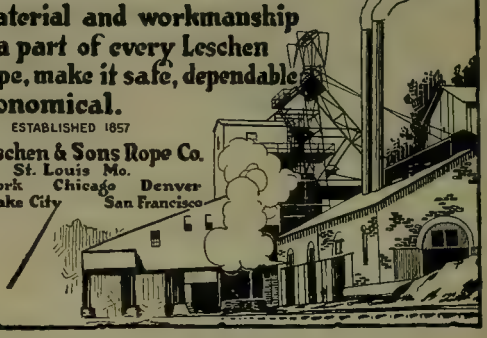

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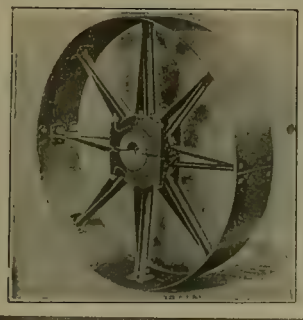

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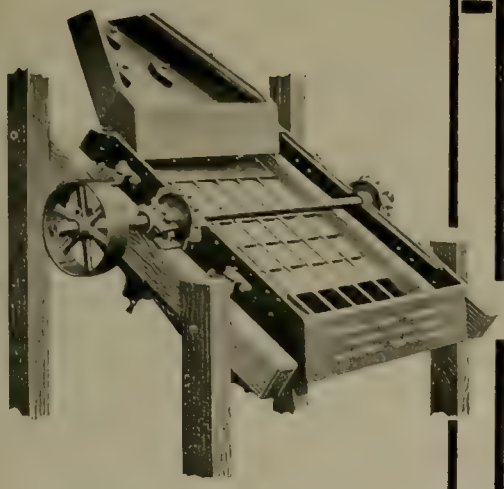

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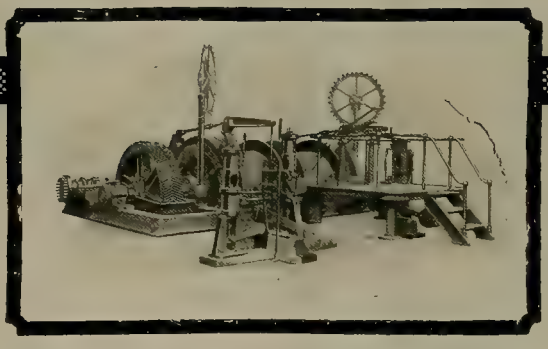

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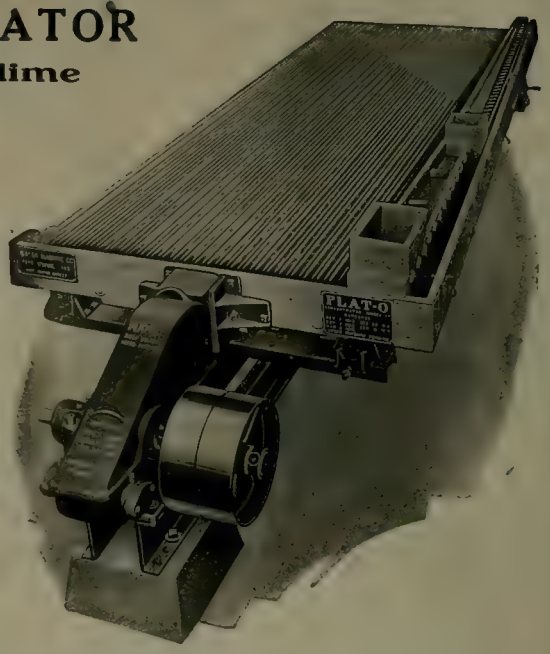

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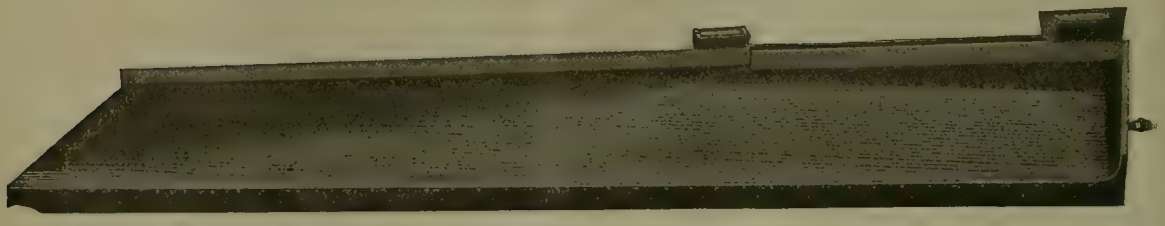

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"WHAT we seek is the reign of law, based upon the consent of the governed and sustained by the organized opinion of mankind."

SULPHURIC ACID manufacturers are now restricted by the Price Fixing Committee of the War Industries Board to $28 per ton for the 66° product, and to $18 for the grade registering 60° Baumé. These prices will rule until September 30.

GREAT BRITAIN has undertaken to prohibit the circulation of metallic currency at a premium. An Order-in-Council makes it a criminal offense to sell or purchase any coin current in the United Kingdom for an amount exceeding the face value of the coin. The restriction applies also to the offering or accepting of coin in payment of any obligation at a higher rate than its minted denomination. This is a wise provision, although it establishes officially the depreciation of the purchasing power of gold that the acceptance of specie at a premium would tend to alter.

LABOR is not a commodity, so declared the American Federation at its recent meeting in St. Paul. This raises an interesting question, the answer to which will be expressed in the relation of the worker to industry after the War. Under the old system, which still prevails, the value of labor is appraised and is paid for in terms of the monetary standard. It thus falls into the category of merchandise. If it is not that, then it must be classed with capital and should accept the risks of reward incident thereto. Organized labor has persistently declined to do that. Profit-sharing is quite a different thing; it still shields the workman from the financial dangers that beset the capitalist. In the declaration made by the A. F. L. we perceive the familiar argument of the socialist. It is evident, however, that the laboring classes, as represented by their leaders, are close students of political economy. Whether they advocate fallacies or not, they thoroughly understand the principles upon which our present economic system is founded. It is safe to say that, as a class, they understand these matters better than the large majority of manufacturers and business men. If we are to deal intelligently with the great social questions that confront us it will not suffice to acquire haphazard ideas concerning them from the experiences of our daily life. Exact knowledge of the fundamentals must be obtained by systematic study. The mining engineer must add economics to the long list of sciences he is required to master.

TIN is one of the few metals in which the United States is deficient, despite the efforts made to develop such deposits as exist in several of our mining regions, notably Alaska, California, Dakota, and the Carolinas. It is interesting therefore to record the fact that the War Department, on the initiative of the War Industries Board, has commandeered the Cash tin mine in Virginia. The prospect in question is on Irish creek, in Rockbridge county, Virginia; it has been tied by litigation for many years, although well reported by successive engineers. The War Department will execute a lease to responsible parties on condition that they proceed to work in a systematic manner, and to ensure this the Department will nominate an engineer to supervise the operations. At the same time the English owners of the Temescal tin mine in southern California have made it possible for a group of capable American engineers and capitalists to begin production from that long neglected but apparently meritorious property.

FINANCE is rarely inspiring, but the generous form of reciprocity lately introduced into the relations between this country and the republics of South America is beginning to effect a conquest of mutual goodwill rather than of commercial advantage that awakens sentiments of kindly neighborliness. We have referred on several occasions to the device by which trade-balances in favor of the Argentine and Peru are allowed to constitute a gold-credit for their account in the United States Federal Reserve Bank, against which the governments of those countries issue currency, yielding them the profits that always accrue from the emission of paper against a metallic reserve. Both we and they benefit by the arrangement, and the exchange of commodities is encouraged and facilitated. So successful has the scheme proved that Chile now has joined the list, and similar arrangements are being made with other Latin-American states. It has been suggested that the gold-credit, amounting to nearly $2,000,000 per month, that is growing in England for the account of China in payment for the 150,000 coolies now serving as a labor-

army in France, might be employed in the same manner. The idea carries with it a closer drawing together of the nations in the compact, under conditions of mutual trust and responsibility. A sentiment of fellowship, which facilitates international co-operation, develops from this to a degree that trade alone never has been able to accomplish. The Administration is to be congratulated on the evolution of this wise plan of reciprocity.

IT is surprising that people so clever as the Japanese should send representatives to this country that cannot speak English. For example, Prince Yoshihisa Tokugawa is paying us a friendly visit as a representative of the Japanese Red Cross; he was a guest of the Commonwealth Club in San Francisco and delivered a speech in Japanese, which was translated by a Japanese interpreter whose rendering of it in near-English was only a little more intelligible than the original utterance. Of course, it is an American custom to send gentlemen quite unable to speak any language but their own to represent the United States in foreign countries and the absurdity of the practice is not fully appreciated; we can claim no superiority over the people of Japan in this respect, and yet we venture to express surprise that they should imitate our blunders. Again, our readers are aware that a large number of technical men come from Japan to visit our mines and smelters; we ourselves have had the pleasure of meeting many of them; and in doing so we have marveled why they did not learn English before beginning their journeys of observation, for our own experience has taught us that all the resources of the language are needed in order to obtain accurate and detailed information on technical matters. How can a Japanese possessing hardly enough command of English to order a breakfast expect to extract trustworthy information on mining or metallurgy in the course of his visits to our mineral regions. We hazard the guess that some of the note-books carried back to Japan contain a great deal of inchoate matter. Perhaps one of our many friends in Japan will explain the anomaly. We refer to it only in order to promote a mutually good understanding.

COPPER is now quoted officially at 26 cents per pound. On July 2 the War Industries Board raised the price 2½ cents from the 23.50 cents that has prevailed since September last. This fixation of price, subject to revision on August 15 next, was made by agreement between the price-fixing committee of the Board and the principal producers of the metal. In taking this action, the Board stipulated that the producers will not reduce the wages now being paid; that they will sell to the Government, to the public, and to the Allied governments at a price not above this maximum of 26 cents; that they will take the necessary steps, under the direction of the Board, for the distribution of the copper, so as to prevent it from falling into the hands of speculators; and that they will pledge themselves to exert every effort to maintain production. It is worthy of note that the Federal Trade Commission has reported that 21 copper-mining companies in 1917 made profits ranging from 1 to 107% on their investments, the average profit being 24.4%. Probably over 70% of the production, it is said, was obtained at a price yielding 20% on the investment. In 1913 these same companies earned an average profit of 13%, the range in that normal year being between 1 and 56% on the investment. The significance of these statements hinges entirely on the definition of 'investment,' as to which the copper-producers and the Commission are likely to disagree. The 'profit' does not include Federal income or excess-profit taxes. The question now arises as to whether the labor-unions will demand an increase of wages on the basis of the former agreement whereby their pay was fixed by a sliding scale in which the price of copper was the determining factor. It is likely that the mining companies can show that the advance of 2½ cents is absorbed by increased taxation, higher railroad freight-rates, and by the advance in the cost of supplies. The publication of trustworthy data on these matters would be wise.

LAST January we criticized the delay of the Government in adopting a practical policy for supplying the fixed nitrogen that we need; we also censured the officials that permitted the advice given by friends of Germany to defeat the purpose of the Act passed by Congress in the summer of 1916 appropriating $20,000,000 for a suitable plant. These Teutonic obstructionists managed to befuddle our officials so far that they took no action to break ground for the construction of a plant until last November. Then the country was told that a great factory would be ready at Muscle Shoals, Alabama, by July of this year. We do not care to pose as prophets of evil, yet neither are we willing to encourage faith in the impossible, so we denied that the thing could be done. To promise miracles is a poor shield for past errors in judgment, as is now proved by the announcement that the contractors hope to have the first unit complete this autumn, and that it appears doubtful whether the full plant will be ready in less than two years. Meanwhile we are depending mainly upon nitrate from Chile, and the Shipping Board is rushing vessels, almost in ballast, to Chilean ports in its haste to obtain the precious salt for making munitions. At the same time the cotton crop this year is being grown largely without fertilizers, which will proportionally lessen harvest, and the Hawaiian sugar growers announce that the shortage of nitrate is so serious that the crop this year will be reduced by half. It is well enough to proclaim the great things that our country is accomplishing, but we must not forget that in a thousand subtle ways, even through men that preach patriotism and make ostentatious sacrifices in public, does Germany work in our midst to slacken our speed, to reduce our harvest, and to oppose our use of improved methods by advocating more tests where we already know enough to ensure good results. The bungling in this nitrate business is one of the most preposterous scandals that has come to light. Its effects are just beginning to be felt. The Government has taken what nitric acid it needed for making powder, because we

could not maintain a scorching battle-front without it, but to this end we have had to rob the soil of fertilizer, involving lessened crops, higher prices, and financial hardship for all the people. The men who counselled the Government to waste time in 'prudent' experimenting upon the methods for fixing nitrogen, which Germany already was using to supply her wants, committed a crime against the American people; they should all be set aside for the duration of the War, so that they may do us no further harm.

Why Worry Over Buchanan Now?

At a time of national stress, when the united enthusiasm of all Americans is essential for our country's good, the spectacle of the Senate occupying the best part of a day in raking up the buried animosities of the Civil War is disheartening. Our 'scholar in politics,' the distinguished senator from Massachusetts, allows his political prejudice to cloud his good sense. The question at issue was the mere authorization of a site in some public place in Washington for the erection of a statue to a past-president of the United States, James Buchanan, for which a sum of money had been bequeathed in the will of his niece, Harriet Lane Johnson. The resolution had already passed the House without exciting serious comment, for manifestly a discussion at this time that revives sectional feeling could find no justification. The attempt to brand Buchanan as a traitor has utterly failed in history; we are left with the picture of an old man of irresolute character facing a crisis too great for him, and made the more timid because a few months later he must vacate his office in favor of Abraham Lincoln. Trying to please both the North and the South, he won only hatred and scorn from both. Yet, he was a great statesman; even his enemies conceded that he was incorruptible, and his whole life was spent in the devoted service of this country. Men of disloyal heart cannot so far conceal that fatal blemish as to pass the winnowing of a presidential election. The feebleness we talk of when we criticize some of our past executives is a matter of comparison among the giants, for weak men do not become presidents of the United States. It is unbecoming of Senator Lodge thus to assail one who has held the highest office in the gift of the Nation, and who was never convicted of wrong by the only competent Constitutional tribunal while he was alive. Any man who has won that great distinction is entitled to honor. It is petty to recall a lapse of good judgment in the Ostend resolution, which looked with aggressive jealousy toward Cuba, when another recent president, whom all America honors for rare achievements, sent a message of congratulation prematurely to the anticipated infant republic of Panama; also it were to look too curiously if we should venture to scrutinize the halting policies of presidents in the last days of their administration. Our Mexican policy started off on the wrong foot for that very reason, and we believe that no one now regrets it more keenly than ex-president Taft himself. We submit that a president should be a firm executive, according to the light of his understanding and belief, to the last act of his administration, regardless of his successor. It will tend to stultify our Government if it is to be crippled in decisive action from November to March every time that a new president is elected. An exhibition of that weakness has been given many times, and when the hour is not critical no one cares deeply, but in Buchanan's day they did, and there was reason for it. Nevertheless, it is a narrow view of civic responsibility that inspires an attack by a scholarly senator at this particular moment when he cannot do it without stirring sectional passions that are being finally and utterly obliterated under the welding heat of a united struggle to the death.

Labor and the War

On other pages of this issue we publish the larger part of two speeches made at a recent meeting of the Butte section of the Institute by Messrs. Sidney J. Jennings and E. B. Howell. The subject was the relation of the mining company to its employees and the improvement of that relation in the interest of industrial development. Mr. Jennings quotes the old saying about a corporation; it was Thurlow that said "it has no soul to be damned and no body to be kicked," but the law has found something to kick and the humanitarian has discovered a soul to be saved. Indeed it is remarkable today how many clever men, immersed in financial or technical operations, have suddenly awakened to an appreciation of economics on the one hand and of human welfare on the other. Some of their statements have a naiveté that disarms criticism, for the convert appeals to a generous mind. Indeed, it is most encouraging to observe how captains of industry are beginning to recognize that workmen are not cattle, because, among other things, they vote; also that companies have responsibilities to others than their shareholders, namely, to the community amid which they operate. The relationship of labor to capital is discussed nowadays in terms less abstract than of yore, we recognize that each stands for human beings, living in a democratic world, the chief ideal of which is the essentially American idea of giving to every man a chance. The War has contributed to this development. Armageddon has involved not a contest between mere professional armies, but between entire peoples; thereby emphasizing the importance of the stand taken by labor, both as an organized party and as a mass of individuals. The workman, or manual laborer, has behaved well, rallying patriotically to the call of his country, in England, in France, and in the United States. Mr. Samuel Gompers deserves the esteem he has won by his cordial support of the President, and the American Federation of Labor deserves the thanks of the country for its willingness to subordinate its smaller aims to the larger necessities of the hour. This has led to a not unpardonable exaggeration of the part played by labor, culminating in the pronunciamiento of the British

Labor party and the general recognition of the fact that industrial conditions 'après la guerre' are likely to be modified profoundly by the larger influence of labor parties, at home and abroad, in shaping policies of reconstruction when peace supervenes. Many of the inferences now commonly made on this subject are reasonable enough, but we are inclined to subject them to some discount because it seems to us that not to the laborer as such but to the fighting soldier returning from the battlefield we must look for the larger influence in the days to come. Despite all the talk of the sacrifices made by those that stay at home, it is to the man at the front that we shall owe our escape from German domination and from all the repugnant things that accompany such domination. Labor has profited too much by the War to be in a position to demand an excess of sentimental gratitude; it has been rewarded already for its willingness to work in the national cause. Miners that are receiving $5.50 per shift and iron-workers that receive anywhere from $7 to $10 per day make no great claim for sympathy as compared to those that have lost an arm or a leg in battle, or those that have lost their business or professional position by their willingness to shoulder a gun. American workmen that threaten to strike when they are receiving $5 or $7 per day may be reminded of the stand taken by the workmen of Belgium in their courageous opposition to the German invader. Of the 1,000,000 workmen in that sorely tried country, fully 750,000 have refused persistently to work for the Enemy, even after an effort has been made to terrorize them by deporting 150,000 of them to Germany and returning them in a broken-down or dying condition to Belgium in order to warn the remainder. No wonder the late Von Bissing confessed that the Belgians presented "a psychological problem." The German system of bullying and frightfulness failed to shake the steadfast resolve of the Belgian not to work for his enemy, not to make concrete, sand-bags, munitions, implements, or anything else that would aid the German effort to crush Belgium, France, and as much more of civilization as the Hun could bestride. The Belgian workman has fought as effectively as the Belgian soldier; he has disdained high wages, safety, and food in his determination not to become the tool of the tyrant. No; in the end we civilians, the mass of non-combatants constituting the community protected by the armies now engaged amid the smoke of battle, will feel indebted most of all to those that risked their lives for us, and while we shall recognize the good sense shown by those that did their duty at home, we shall be disinclined to accord to the enriched laborer any excess of adulation for his willingness to behave while receiving high pay. On the other hand, the returning soldier will impose some of his ideas upon us; he will have lived under the democratic conditions of an equal risking of life for a great cause; he will have learned to respect only those that can make good; he will have scant respect for privilege as such; even amid the horrors of war he will have become steeped in the true spirit of humanity—to live and let live. To him the laborer may look for sympathetic understanding, and to him the man of skill and of brains may appeal with confidence. Conditions 'after the War' will be in the hands of the best of this generation, in those of the courageous, vigorous, and clear-sighted young men that performed their supreme duty cheerfully, instantly, and successfully. We do not fear a future that is to be molded by them.

The Mexican Editors

Relations with Mexico are becoming more acute each day. Diplomatic notes just published show that our Government has made a peremptory demand upon Carranza that his confiscatory tax on oil properties shall not apply to the holdings of American citizens. At the same time we must direct attention to an insult offered to this country by the visiting Mexican editors, despite the courtesy that President Wilson showed them in an effort to display our goodwill toward their country. His address to them set forth disinterested motives and positive friendship toward Mexico, such as all intelligent Americans will endorse; and he accorded them the privilege of printing his remarks in their own papers before releasing them to the American press. The result was a garbled publication that put the President, and the nation for whom he spoke, in a false light before the Mexican people. Since then these Mexican visitors have been entertained in the principal cities of the country; they have been shown munition-shops, shipyards, and other industrial plants, from which even the average American is barred. We must remember that these are trained observers, that they are men of understanding, and that they edit papers controlled by a dictator masquerading as a representative ruler, a man whose hostility to us has been unwavering, and whose friendship for Germany has been a growing menace to our welfare. The construction to be put upon the attitude of our Government in showing them our factories is that they will carry back to Carranza the proofs of our invincibility, and demonstrate to him that his own best interest will be served by getting off the fence on the American side. He has been so eager to stand with the winner that his favors swung for a time like a pendulum between the United States and Germany; finally he was influenced by the insistent Teutonic propaganda, conducted in a manner beneath the dignity of a self-respecting nation, to credit the testimony dinned into his ears that the success of the German arms was assured. Men like Señor Luis Olivera, the accomplished editor of 'El Universal,' whose speech at the luncheon tendered to the party in San Francisco displayed so clear an understanding of our resources and military readiness, will take home to Carranza a different impression. The visiting editors must now realize how remote from our thoughts is the idea of aggression, and how fully the American people endorse the pledge given by President Wilson to protect the autonomy of every Latin-American country. We would not be surprised after this to see financial arrangements, similar to those that have stimulated so kindly a feeling between the United States and the Argentine, become the basis of a rapprochement with Mexico.

Doctor Douglas

The Editor:

Sir—It is by way of being formal that we speak of him as James Douglas. As a matter of fact America is full of James Douglases; so is Scotland; and they stretch in a long line of rugged, intellectual, capable men back to that remote Sir James of Castle Dangerous, who knew, in his medieval way, how to make his name respected, and to blaze the trail for Scottish progress; but there is only one 'Doctor' Douglas, and that is the honored dean of American mining engineers, who has left us in the flesh but will remain with us in the spirit always. This is no mere figure of speech. He did more than open great mines, yet great mines in themselves constitute one of the most important sources of national strength; their development means the creation of centres of re-vitalization for society; and the men who develop them have helped to direct human progress and to determine human destiny in a very large sense. Though Themistocles, for example, did many things as politician and statesman, for which he is chiefly celebrated, his most significant achievement was in turning the mines of Laurium into a reservoir of national strength. He caused the intensive unfolding of their treasure, and thereby made it possible for Greece to live and to sustain the growth of culture and finer manhood, because he persuaded his fellow Athenians to permit the use of the silver from Laurium to build a fleet. So it happened that the fleet built from these revenues saved not only Greece, but all Europe, from being engulfed in the savage romanticisms of a Persian 'kultur.' Can anyone disentangle the name of Themistocles from the mines of Laurium or from the web of Grecian history in which he was a vital thread? The life of Doctor Douglas also is a vital thread in the strong fabric of American development. That is not to say that he was an essential thread in it, for he would have been the first to confront me with the philosophic truth that no man is essential. The world will career along its way whether one or another live or die; but in retrospect there are those who are forgotten and those whose lives were so vital that things would have been altogether different had they not lived and labored and filled the age in which they worked with something better than material achievement. It is a distinguishing characteristic of this great miner that he vitalized a necessary profession with a new understanding of its spiritual obligations. He lifted it above the mercenary; he remembered man as an instrument in the making of the industrial strength of the nation. Far beyond Bisbee and Arizona, and the South-West, his spirit illuminated the lives and directed the thoughts and activities of men over whom he exerted the influence of a guiding mentality so high that it made him the intellectual father of many. It was because he dared to open his mines and smelters and workshops to all who came in the spirit of learners that mines and mills and smelters throughout America have accepted the democratic doctrine of generous educational exchange. It was because his sympathy reached down to the miner, and to the miner's wife and babies, that the broad principle of accruing annuities for old age, and protection to the family after death, became a humanitarian example of justice to the workingman so widely followed. It was he who showed the way, not to a crude profit-sharing, but to actual participation in the ownership, by offering to every employee the chance to accumulate stock in the great Phelps-Dodge chain of industries, held in the treasury available for them to acquire at par by small payments out of wages, although the premium on these shares was so great as to multiply the investment many-fold as soon as any workman completed the easy purchase and had the transfer made on the company's books. His spirit was of the sort that ennobled those with whom he dealt, and this quality was impressed upon his welfare-work; it was always cultural, expansive; it never was offered as a largess, it never made a man feel dependent; on the contrary, it placed the beneficiary on the footing of self-respecting manhood, making it self-evident that he was the beneficiary not of an institution but of his individual effort. This method of dealing with men as men instead of as servants he impressed upon the corporation whose policies, consciously or unconsciously, he molded into a reflection of himself, for he was associated with a group of kindred natures, who found in him a nobility of character that was irresistible in its power of leadership. He was fortunate in these rare associations; it gave him freer scope; the seed had fallen in good ground and the plant was not withered before the harvest.

It was not merely as a practical man, as a competent man, that he made his deep impress upon the work of his generation; it was chiefly in his example as a broad-minded spiritual leader of the men in the profession of mining and metallurgy at a critical period in our national development, that he justifies the parallel with the renowned Greek. It must be observed that his span of activity covered the growth of mining in the West from the time when it was a scramble for spectacular riches to its maturity as a vast industry founded on true conservational principles, and he was a directing force, by ex-

ample and by doctrine, in promoting this evolution. The young engineers recognized in him the quality of a kind wise father to them all, one who remembered his own early struggles, who appreciated their difficulties and understood their aspirations. A multitude of American engineers will claim the privilege of naming him, above all other men, their professional father. Even those who did not know him personally, but had merely read his unpretentious words of scientific instruction and human counsel, felt his power, and recognized his fatherhood in their thought and in the practical administration of their duties. When a man becomes a master, first over himself and over the work allotted him to do in life, and then comes to make himself felt as a guide to successful endeavors by others, because in him is found wisdom, competency, truth, justice, and love, and when this influence extends over a continent in its moment of change from an untamed desert to a bulwark of national strength at a great crisis in the history of civilization, there is no exaggeration in naming him as a factor in our preparedness without whom we would not have been so well able to gird on our armor in time. Moreover, he knew what he was doing without boasting of it; he never espoused the weak and puling tenets of the pacifists; he was kind, he was loving, he was humble; but he was also a militant nature, a man's man, disdaining maudlin sentiment.

The records of his special service to his profession, to Canada the land of his birth, and to America the land of his adoption, are written elsewhere; they justify this appreciation, which is a tribute that will, I know, awaken hearty response in thousands of hearts. Some of these will testify to his unique qualities as shown in mining; others will think of him as a help to them and to the world in the progress of metallurgy; others will reflect upon his distinction as a builder and manager of railroads that set new ideals of justice and honor in their administration; others, who knew nothing of all these things, will hold happy recollections of the long series of choice contributions to the literature of the day that found their way from his pen into the magazines, and they will express the joy they experienced in reading the plain truths of Canadian and New England colonial history interpreted sympathetically by this keenly analytic mind. Again, there are the students who have gone forth from Columbia University, to whom he was 'our Doctor Douglas,' carrying his inspiration in their hearts, scarce knowing that to another body of young men, those of his own Alma Mater, Queen's University in Canada, he also stood as a commanding Chancellor, their idol, their spiritual and intellectual mentor. A man who has touched the hearts of youth with the flame that kindles to high endeavor, who has created ideals for a great fraternity upon whose skill and industry the nation depends so largely for defence in war and for progress in times of peace, is one whose name will live and be known with increasing honor as time clarifies in sharper outline the greatness of his work.

COURTENAY DE KALB.

Stanford University, California, June 30.

Conservation of Technical Engineers

The Editor:

Sir—In the issue of your journal for June 15 I have read with interest your editorial entitled 'Conservation of Technical Engineers,' and as a true American citizen I agree with your sentiments heartily. In another journal I have noted that the U. S. government asks for 2000 experienced engineers between the ages of 32 and 42 to make application to attend the Engineers Training Camp. If the applicant is lucky after attending this camp he may be given the rank of lieutenant or captain. This seems to be rather unfair in view of the fact that all doctors, without any of this preliminary training in camp, on entering the service, be they good or bad, are given the rank of captain. Knowing you to be an engineer whose heart has remained with the members of the profession I beg to mention this apparent discrimination so that it may be corrected before all active practical engineers have become promoters or store-clerks.

A MINING ENGINEEER.

Los Angeles, June 19.

[It is pleasing to note that our correspondent, in common with many others, so fully realizes the error that was committed in allowing our young technical men, under the impulse of splendid patriotism, to rush into branches of the military service where their technical knowledge was largely if not wholly unused. This is very much like mining an argentiferous silver ore having a barite gangue, sorting out the rich galena with its precious accompaniment to be thrown over the dump, while shipping the barite to the paint-manufacturer. Estimates of the number of young men in training for technical work and of recent graduates that on the threshold of their career have joined the colors show that the country is short approximately seven annual crops of scientifically educated recruits to its industrial enterprises. These are the men on whom we depend to insure efficient intelligent supervision of the complicated operations that are devoted to supplying our fighting men at the front. Perhaps the doctors fare better than the engineers; but we would complain less of discrimination as regards the rank given those actually enlisted in the engineering corps, where their special talents are utilized, than we do of the wastage of trained men in a kind of service that does not call for the knowledge of chemistry, metallurgy, or electricity.—EDITOR.]

COPPER production for 1918 is estimated to exceed the output of last year, when it was 2,400,000,000 lb., being a high record in that industry. It is stated that 95% of the entire consumption of copper is directly or indirectly by the Government.

MINERAL PRODUCTION of Korea in 1917 was valued at Y24,081,127 (1 yen = 50 cents), a decrease of Y30,000. The Oriental Consolidated, Seoul Mining, Chicksan, and Chosen companies contributed the most of this, in gold, copper, and tungsten.

Apexes and Anticlines

By ROBERT M. SEARLS

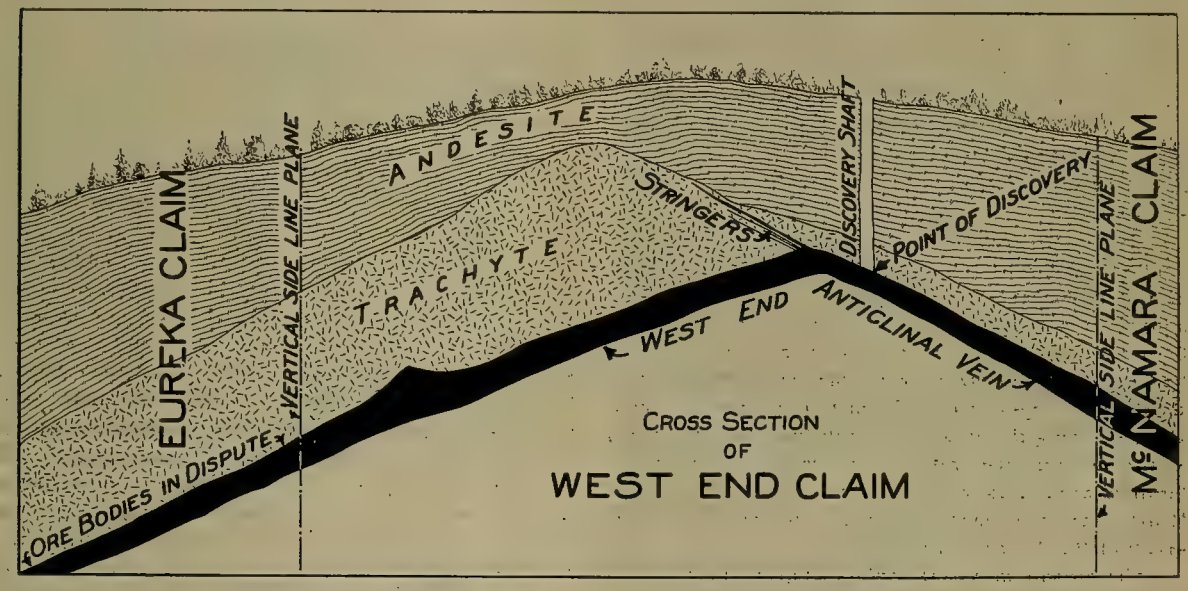
The Supreme Court of the United States has been heard from again on the extra-lateral question, and a new field of combat over apex problems has been opened up. The case at bar was the old controversy between the Jim Butler Tonopah Mining Co. and the West End Consolidated Mining Co. The essential questions involved were:

First: Can the crest or crown of a vein that is found in the form of a single anticline, dipping in both directions, and having no defined terminal edge, be considered as an apex upon which extra-lateral rights can be predicated?

Second: Having such a vein, can the locator of a claim, in which the crest of this anticlinal roll is found, follow both limbs of the vein extra-laterally through opposite side-lines?

A careful reading of the opinion indicates that the Court has evaded a decision on the first question by refusing to go back of the trial-court's finding that an apex as a matter of fact existed, and that it has decided the second question in the affirmative. The opinion will be better understood if the facts are outlined. The following sketch, adapted from defendant's exhibit G, modified in accordance with the Court's findings, is illustrative of the situation.

The West End company owned the West End claim in the Tonopah district, Nevada. The Jim Butler owned the Eureka and Curtis claims adjoining the southerly West End side-line. All the claims overlie what was known in the early days of Tonopah as the 'big flat vein,' which is the subject-matter in dispute. This vein has the crest of its anticlinal fold in the West End claim, cutting the easterly end-line and the northerly side-line. From this crest the vein dips in both northerly and southerly directions at an angle varying from 17° to 30° in different parts of the claim, and crosses the opposite side-lines on the dip. The crest of the fold is covered to a depth of several hundred feet by volcanic flows of 'Midway andesite' and 'Fraction dacite-breccia.' Discovery was made on the West End claim through a shaft driven through this cap to a point on the northerly dipping limb of the vein. The orebodies in dispute were in the southerly dipping limb of the vein, just beyond the southerly side-line of the West End, and vertically beneath the Jim Butler claims. In the trial court the main dispute was whether the West End vein was originally one vein, or two veins, one cut off by the other and practically joined at their upper terminal edges. The trial court found that but one vein existed; it called the crest of its anticline a "junction or union" between its "two limbs or sides"; it defined this crest or axis as an apex; and, as has been said, awarded the West End company an extra-lateral right in both directions.



As to the existence of an apex, the Supreme Court, after quoting at length the finding of the trial court, summarizes it as follows:

"Giving due effect to the finding, it is manifest that the vein in controversy is not a flat or horizontal vein or one which would be practically horizontal but for a succession of rolls or waves in its elevation. On the con-

trary, it is shown to be a fissure vein with two dipping limbs whose course downward is substantial, regular, and practically free from undulations. For 750 ft. out of its total length of 1150 ft. within the West End claim each limb is practically a separate vein with a distinct summit or terminal edge. For the remaining 400 ft. the two limbs are united and from the point of union the mineralized quartz or rock continues upward for from 20 or 30 to more than 100 ft., and this seems to answer all the calls of a summit or terminal edge. In these circumstances we hardly would be warranted in saying as matter of law that the vein has no top or apex within the claim in the sense of the statute. See Stewart Mining Co. v. Ontario Mining Co., 237 U. S. 350."

An examination of the record leads one to wonder how the above conclusion was reached. The evidence was not in dispute as to the existence of vein-matter throughout a large portion of the exposure between well-defined walls of andesite and trachyte or rhyolite and trachyte. The whole vein-formation is unquestionably anticlinal in its general characteristics. True, the hanging wall at the crest of the fold was traversed by stringers of vein-matter continuing upward for a distance, forming what was termed at the trial a "halo," as observed by the Court in its finding. But this condition also prevailed to some extent on the dip of the vein, and was due in all probability to replacement along subordinate fissures extending into the hanging wall. The existence, at the crest of the fold, of the stringers that were minor features when compared with the great width of the main vein, in view of the obvious roll in the formation as a whole, hardly warrants the view that these constitute a true apex, especially since practically all these stringers along the crest of the roll dipped to the north and away from the orebodies in dispute. Certainly a terminal edge to the vein is lacking. That the Supreme Court was in some doubt is indicated by the closing paragraph of the decision where it said:

"The contention is not that the top or apex of this vein has been found elsewhere, but only that what is found in the West End claim is not such in the sense of the statute. 'The law,' as has been truly said, 'assumes that the lode has a top, or apex, and provides for the acquisition of title by location upon this apex.' Probably this assumption could not be indulged where the fact appeared to be otherwise, but it serves to show that the absence of a top or apex ought not to be adjudged in the presence of such a finding as we have here."

The second conclusion of the Court, that, granted an apex exists, the vein may be followed extra-laterally in opposite directions, is perhaps open to little criticism. The Act of 1872, Rev. Stat. 2322, gave to the locator the right to follow "all veins, lodes, and ledges throughout their entire depth, the top or apex of which lies inside of such surface lines extended downward vertically, although such veins, lodes, or ledges may so far depart from a perpendicular in their course downward as to extend outside the vertical side-lines of such surface locations."

In many decisions this provision of the law has been held to grant to the locator all the veins whose apexes are within his location. While it may be that no specific case has been passed upon where secondary veins dipped in opposite directions from the discovery vein, there is certainly no exception in the above quoted section of the Act to justify an inference that the extra-lateral right on either vein would be denied the locator if they did dip in opposite directions. If then the right exists where two veins with separate apexes dip at a diverging angle, why should it not exist where a single apex is found and the vein splits into two diverging limbs that cross opposing side-lines? The Supreme Court followed the line of reasoning just stated, and it seems cogent. If the apex be assumed, then the extra-lateral right follows under the law, within parallel end-lines, no matter in which direction the particular veins may dip.

The decision as a whole serves to emphasize the common sense of the juries of citizens that sat in the Leadville cases in Colorado and refused to find that such a thing as an apex could exist under conditions not greatly dissimilar to those in the Jim Butler case. If an apex be conceded, and the end-lines are parallel, then the extra-lateral right follows even if it bars mining by all the other claim-owners in the district. But the burden of proof is on the extra-lateral claimant to prove his apex. Where a blanket vein, or one dipping at a flat angle, extends for a considerable distance beneath a given district, justice to a multitude of neighboring locators and the public interest, in freedom of opportunity to all, seems to require that such a claimant should be held strictly to sustain fully that burden before his extra-lateral claims receive judicial confirmation. He should be required to show something more than the summit of an anticlinal roll with a few stringers projected into the adjacent country-rock. He should be asked to show beyond doubt that there is but one crest, and that he is not basing his claim upon the discovery of one of a series of elevations or folds in the vein-sheet, none of which may properly be classed as apexes. A terminal edge should be shown in conformity with the rule in the Leadville cases.

The Supreme Court based its decision ultimately upon the particular finding of fact of the trial court that an apex existed under the peculiar geologic conditions there exposed, but announced no general principle or rule by which we may be guided in the future. Whether the crest or axis of an anticlinal vein without stringers projecting upward from this crest or axis is an apex is not determined.

The Court has indicated in the Jim Butler case that it will not upset the trial court's findings of fact on the question of apex existence. Surely this attitude throws upon our trial courts the duty of scrutinizing the evidence in such cases with great care, in order that the apex law, which has been shown to be founded upon sound principles of equity when applied to deep-lode mining, shall not, in cases where the vein approaches the horizontal, work an immeasurable advantage to one locator at the expense of an irreparable injury to all his neighbors.

Gold and Silver Mines of the United States

During 1916, the last year for which data are available, there were 1530 placer and 3765 deep gold and silver mines in this country. Alaska led with placer properties, having 650, and only 47 deep mines, while Colorado had the most deep mines—825—but only 27 placer properties, according to the U. S. Geological Survey.

The principal gold-producing States were California, Colorado, Alaska, Nevada, and South Dakota, contributing 80% of the total in 1916. The principal silver-producing States were Montana, Nevada, Utah, Idaho, Colorado, and Arizona, accounting for 90% of the total.

The mines, in order of output, stood as under:

GOLD

Operator	State	Mining district	Source of gold
Homestake	South Dakota	Whitewood	Dry or silicious ores
Yuba Con.	California	Marysville	Dredging gravel
Goldfield Con.	Nevada	Goldfield	Dry or silicious ores
Empire Mines	California	Grass Valley	do
Alaska Gastineau	Alaska	Juneau	do
Cresson Con.	Colorado	Cripple Creek	do
Portland	do	do	do
Vindicator Con.	do	do	do
Alaska Treadwell	Alaska	Juneau	do
North Star Mines	California	Grass Valley	do
Yukon Gold	Alaska	Iditarod and Ruby	Dredging gravel
Alaska United	do	Juneau	do
Utah Copper	Utah	West Mountain	Copper ores
Kennedy Mining	California	Jackson	Dry or silicious ores
Liberty Bell	Colorado	Upper San Miguel	do
Tomboy	do	do	do
Nevada Con.	Nevada	Robinson (Ely)	Copper ores
Anaconda Copper	Montana	Summit Valley (Butte)	do

[Since the above table was prepared, there have been many changes. Alaska Treadwell is closed, Goldfield Consolidated has fallen off considerably, while the United Eastern in Arizona should take about third place.—EDITOR.]

SILVER

Operator	State	Mining district	Source of silver
Anaconda Copper	Montana	Summit Valley (Butte)	Copper ores
Hercules Mining	Idaho	Leland	Lead ores
Tonopah-Belmont	Nevada	Tonopah	Dry or silicious ores
Butte & Superior	Montana	Summit Valley (Butte)	Zinc-lead ores
Tonopah Extension	Nevada	Tonopah	Dry or silicious ores
Chief Consolidated	Utah	Tintic	Lead ores
Tonopah Mining	Nevada	Tonopah	Dry or silicious ores
Bunker Hill & Sul.	Idaho	Yreka	Lead ores
Caledonia Mining	do	do	do
Federal M. & S.	do	Hunter	do
United Verde	Arizona	Verde	Copper ores
North Butte	Montana	Summit Valley (Butte)	do
Silver King Coalition	Utah	Uintah	Lead ores
Calumet & Arizona	Arizona	Warren	Copper ores
Hecla Mining	Idaho	Leland	Lead ores
Greenhill Cleveland	do	do	do
Kennecott Copper	Alaska	Kennicott	Copper ores
Copper Queen Con.	Arizona	Warren	do
Jim Butler Tonopah	Nevada	Tonopah	Dry or silicious ores
Nevada Wonder	do	Wonder	do
Presidio Mining	Texas	Shafter	Silicious (silver) ores

ALUNDUM manufacture and use was described by M. A. Williamson in a recent issue of the 'Metal Industry', as follows: Bauxite is calcined in a rotary calciner at 1300°C. and this product is shoveled into the arc between two suspended electrodes in an electric furnace. The furnace consists of a circular steel shell set on a refractory base. A temperature of 2050° is required to melt the bauxite. When the shell is full of molten bauxite the current is stopped and the furnace cooled. The shell is removed and the resulting 'pig' is broken into pieces. These are crushed to any degree of fineness desired, depending on the grade and the use to which the alundum is to be put. It is greatly superior to any of the natural abrasives for grinding and polishing.

The Graphite Market

Crystalline graphite production of the United States in 1917, including stocks at the mines, was 14,000,000 lb., an increase of 3,100,000 lb., according to the U. S. Geological Survey. Figures furnished by the producers of crystalline graphite show that out of total sales of 10,584,080 lb., 6.816,913 lb., valued at $982,336, or about 64% by weight and 90% by value of the total, was flake graphite containing from 80 to 90% of graphitic carbon, in large part suitable for making crucibles. The remainder, 3,767,177 lb., valued at $109,962, was dust or low-grade flake, probably averaging under 50% of carbon. The proportion of flake graphite produced is greater than in previous years, the increase having been due in part to improved methods of milling, whereby a larger proportion was saved as flake, and in part to the fact that, owing to the freight embargo during the latter part of the year, Alabama producers were able to ship only material of high grade. There were 25 mines reporting sales of crystalline graphite in 1917 against 16 in 1916. Alabama was the largest producer in 1917, the amount marketed being 6,223,095 lb., valued at $719,575; New York came next, with 2,941,040 lb., valued at $261,548; and Pennsylvania third, with 804,945 lb., valued at $77,475. California, Montana, and Texas made a combined production of 545,000 lb., valued at $33,700.

Amorphous graphite was produced in 1917 by 5 mines in Colorado, Michigan, Nevada, and Rhode Island. The output was 8301 tons, valued at $73,481, compared with 2622 tons, valued at $20,723 in 1916.

Artificial graphite is manufactured chiefly by the International Acheson Graphite Co., which utilizes electric power generated at Niagara Falls.

Imports of graphite in 1917 amounted to 42,609 short tons, valued at $8,961,988. Imports in 1913, the year before the war began, were 28,885 short tons, valued at $2,109,791. Exports in 1917, principally to Great Britain, France, Canada, and Italy, amounted to 2576 short tons, compared with 798 tons in 1916. Manufactured graphite articles to the value of $891,633 were exported in 1917, against $1,339,259 for such articles exported in 1916.

At present war prices, miners in this country who are working disseminated flake deposits must depend on their No. 1 and 2 flake for their profit. Graphite dust is merely a by-product and is salable only at a low price. Improved methods of graphite milling, adopted during the last year, promise to increase largely the production of flake of better grade.

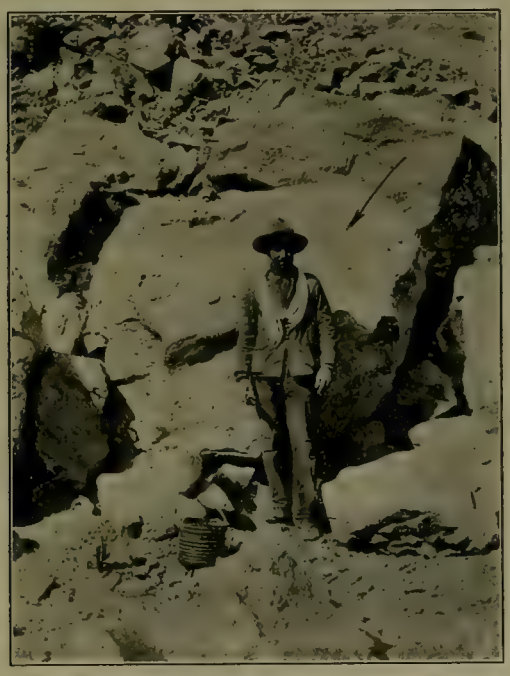
The requirements for 1918 will be between 28,000 and 32,000 tons, which may probably be supplied by domestic, artificial, and Mexican production.

Blasting Methods at Ajo

By S. U. CHAMPE

In the work of excavating the ore in the Copper mountain deposit at Ajo, Arizona, belonging to the New Cornelia Copper Co., two methods of preparing the ground to receive the charges for blasting are employed. One method is to tunnel into the working-face on a level with the floor of the shovel-pit, and the other is to drill vertical holes about six inches in diameter with No. 14 Cyclone gasoline drilling-machines. Before the blasting is done, the ground is closely examined and a careful stadia survey is made to determine the toe and crest of faces and from developing slides, which are dangerous to life and equipment, and are expensive to shoot down. In actual practice 3.44 tons of ore have been broken for each pound of powder used, including that required for 'springing' or chambering the churn-drill holes. This figure was determined from accumulated records of the blasting of 530,600 tons of ore. The ore weighs about 160 lb. per cubic foot.

By the tunnel-method, the tunnels are driven into the face to a depth equal approximately to two-thirds the



BLOCK BEFORE BLASTING

BLOCK AFTER BLASTING

the working-face and the proper situation for the powder-chambers. An effort is made to ascertain the positions of the faults and also of the solid and loose material. The effect of these features on the result of the blast is anticipated. From the data thus secured a plan is drawn, and from this map a sufficient number of cross-sections is plotted to calculate the tonnage that will probably be broken by each charge of powder.

For a working basis, each pound of Trojan 40% powder is taken as having sufficient strength to break four tons of ore. This, no doubt, is an under-estimate of the strength of the powder, but it has proved advantageous to slightly overload the holes. This practice, to a degree, prevents the broken ore from hanging on the height of the ore above the powder-charge. From the main tunnels two sets of cross-cuts are made, one set at the rear of the tunnel and the other about 30 ft. back from the portal. The cross-cuts are driven to such a distance as will make the charges in the rear an equal distance apart for all tunnels. Two powder-chambers, one at each end of the cross-cut, are excavated in the back. In the front cross-cut four chambers are used. The powder-charges are placed about 6 ft. below the floor of the pit. About 20% of the total amount of the powder in each tunnel is placed in the front charges. These figures apply to ideal conditions only. Allowances are made for faults, hard and loose material, height of bank, and other things, so that the amounts of powder may be

proportioned accordingly. The advantages of the tunnel-system are: No springing is necessary before placing the powder-charges; the danger of premature explosions from hot walls, caused by chambering with powder is eliminated; the work can be done with less skilled labor; it is not necessary to build roads over difficult surfaces for the movement of heavy drilling-machines. On the other hand, tunneling into a low bank is as expensive as tunneling into a high one. When this method is used in banks less than 50 ft. high, the cost per ton of ore broken has been found to exceed the average.

FIG. 1. COPPER MOUNTAIN THE DAY BEFORE BLASTING

Churn-drill holes are placed about 50 ft. apart and are drilled to a depth of 6 ft. below the floor of the pit. After using different methods, the mine superintendent, Fred Eckman, is now using the following procedure when chambering churn-drill holes:

1. Use 28 sticks of powder, without tamping, to blow the hole dry, that is, to drive out the water.

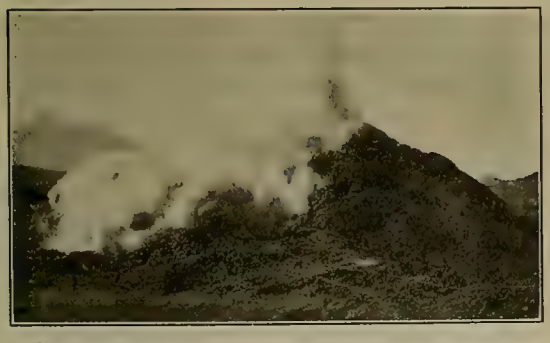


FIG. 3. APPEARANCE OF HILL FOUR MINUTES AFTER BLAST

2. Load the hole with 25 lb. of powder and 15 ft. of tamping. This charge is to enlarge the bottom of the hole to receive the final shot for chambering.

3. Load the hole with one-tenth the amount of powder that is to be used in the blast. If the hole is to be loaded with 80 boxes of powder then use 8 boxes for the chambering-shot; if 100 boxes are to be used, then 10 boxes will be required for chambering. About 40 ft. of tamping is used over the final chambering-shot. After each shot, time must be allowed for the walls of the hole to cool. Repeated tests of temperature are made by lowering a self-recording thermometer into the hole.

There are advantages in using churn-drills. The work can proceed without interference to steam-shovel operations, and where the working-space is limited greater quantities of ore can be prepared for blasting than with the tunnel-method. It is not necessary to wait until the ore already shot down is removed before the work of drilling for the next blast can proceed. Churn-drills have proved exceedingly satisfactory where the working-faces are not over 50 ft. high.

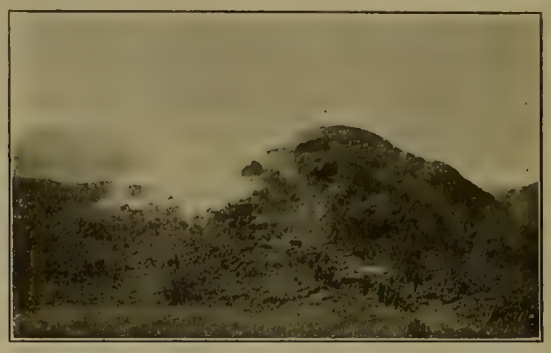


FIG. 2. VIEW AT THE MOMENT OF BLASTING

On account of the extreme hardness of the ore in the Ajo district, it has been found that after a depth of 40 or 50 ft. has been passed the cost per foot of hole drilled rapidly increases.

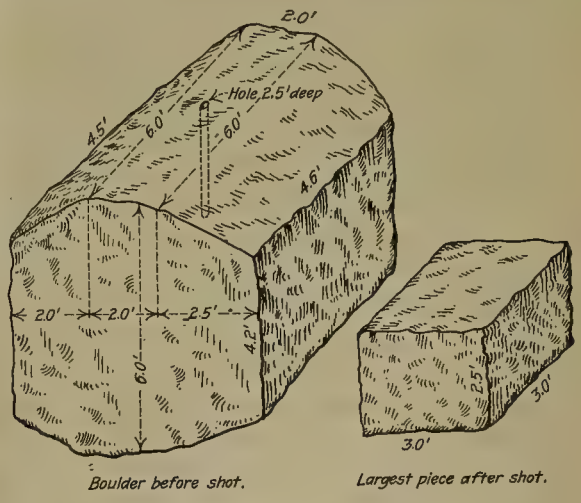


DIAGRAM REPRESENTING BLOCK-HOLING

In the process of excavating the ore in Copper mountain, it was estimated that 200,000 tons of ore was broken by a single blast. This was on February 28, at what is called 'No. 3 hill.' Seven holes were drilled with a churn-drill, each hole being six inches in diameter and 90 ft. deep, spaced 50 ft. apart. A total of 32 tons of 40% Trojan powder was used in the blast. That includes the powder used for springing. The appearance of the hill, as it stood the day before shooting the holes, is seen in Fig. 1. The illustration in Fig. 2 was taken at the moment of the blast, and Fig. 3 shows the effect

as revealed when the smoke had cleared away four minutes later.

All block-holing at Ajo is now done with the same grade of Trojan powder. The practice is illustrated in the accompanying cut and half-tone illustrations. In this particular case a block measuring approximately six feet in all three dimensions was drilled in the centre of one side to a depth of 2 ft. 6 in. Block-holes are loaded with two ounces of the granulated 40% Trojan powder. A fuse split at the end, and without a detonating cap, is next inserted, after which another two ounces of the powder is poured in and lightly pressed down with a wooden tamping-stick. The remainder of the hole is then tamped full of screened sand, and the charge is ready for shooting. In all cases the results are practically the same: the boulder immediately around the hole is completely shattered, while the lower half is split into pieces, the largest of which, in the case cited, is shown on the diagram.

Mexican labor is used for this work. One man with an Ingersoll-Rand BCR-430 jack-hammer can drill 100 holes, averaging 18 in. deep, in eight hours, making all his own air connections. These, as well as the powder-men for this work, are picked men, working most of the time without the direct supervision of a foreman. The labor is very satisfactory.

The drawing shows a common size of boulder in which four ounces of powder is used. If, by inspection, a boulder is approximately half as large, then only two ounces would be used; if twice as large, eight ounces would be required, and so on. At present the powder is stored in two stone buildings, one with a capacity of 200 tons, and one of 100 tons capacity, both about half a mile from the present steam-shovel pits. To date this has proved ample storage capacity for the amount of reserve powder required.

THE chromite production of the United States, according to J. S. Diller, of the Geological Survey, was 43,725 long tons, of which the greater part came from California. Oregon produced 7506 tons, and smaller quantities came from Alaska, Washington, Maryland, and North Carolina. This year the output must be greatly increased. The large consumers are paying $1.25 per unit for 38% ore, that is, $47.50 per ton, f.o.b. cars on the Pacific coast, on contracts extending through the year. A hopeful sign is that some of the large deep gold-mining companies are using parts of their stamp-mills, especially in Nevada county, for crushing and concentrating low-grade chrome ore. The ore sold on the Pacific Coast in 1917 ranged from 30 to 55% of chromic oxide; the average was about 42% for the total output, which sold during the year at an average price of $26 per ton. The total output for the first four months of 1918 is 17,693 long tons, equivalent to 14,862 long tons of 50% ore. That is less than one-third of the total domestic production expected in 1918.

ZINC-DUST is in steady demand, the price for immediate shipment being 14 to 16c. per pound.

Tropical Sanitation

Canal Zone sanitation was good during the first quarter of 1918, according to an official report. Malaria, which is the most important problem of the health department, has been almost extinct in the regular sanitated areas. Many weeks have passed during which no case has been reported. This condition is partly due to the dry season, but mainly to the cumulative results of years of unceasing vigilance and anti-mosquito work, classified as permanent work. Anti-malaria work, which consists of anti-mosquito work, is like fighting a smouldering fire which, if not constantly watched, may flare-up at any time the conditions become favorable. Such will be the case until the malaria parasite or its host is eliminated. Theoretically it is possible to eliminate the parasite causing malaria—more practicable than to eliminate its host, the anopheles mosquito. Elimination of the latter would involve the expenditure of enormous sums of money. Elimination of the parasite could be done by treating all human beings who are infected. The latter method of procedure is also expensive, but must be the goal sought, when, as with yellow fever, there shall be no more sources of infection. The 'aedes calopus' (stegomyia) still exists in Panama, but there has been no case of yellow fever for years. In the meantime the anti-mosquito work must go on as a local measure. The present corps of sanitary inspectors is deserving of great credit. The regular inhabited areas are in better condition than ever before. During the past quarter much permanent work has been done, consisting of additional sanitary ditches ad tile-drains. The total number of cases of malaria reported for the period, among employees, was 160. Of these, 20 are for the Zone proper, and 140 have occurred among employees engaged on plantations and in pasture-clearing camps for the Supply Department, outside of regular sanitated areas, in the jungle. What to do with these men is the problem. The breeding places about these camps cannot be eliminated on account of the temporary nature. The men employed are mostly native Panamans and Colombians, many of whom are 'carriers,' and furnish infected blood to the 'anopheles' mosquitoes, which, in biting 'non-immunes,' cause active malaria fever. It has been suggested that the streams near the camps be left shaded, that is, that vegetation be left uncut, making breeding of 'anopheles albimanus' unfavorable. The favorite breeding place of these insects has been found to be in water exposed to sunlight, especially where certain species of green algæ grow, and where fresh vegetation has been felled along the edge of the stream. It has further been found that 'anopheles malefactor' has not been incriminated as a host for malaria parasites, and thereby becomes of secondary importance. In each of these camps the district sanitary inspector has a trained 'mosquito catcher' who catches all mosquitoes found within the mosquito bars, removing a prolific number of infected mosquitoes. A large number of the bars in use at these camps are too short and do not furnish adequate protection.

The Company and Its Employees

By SIDNEY J. JENNINGS

*The company is a conception of the Roman law. In their time they had the 'collegium' and 'corporati,' which corresponded exactly to our company and stockholders. They had a common fund and could pursue a common object. In modern times the English are the nation which adopted this conception of joint stock companies in the largest degree and the number of companies grew to such an extent that an act called 'the bubble act' was passed in the English parliament in 1719 which declared joint-stock companies to be public nuisances. In 1855 the conception of limited liability, whereby the liability of the stockholder was limited to the amount he subscribed for shares, was introduced by the English parliament. In 1862 the Consolidated Companies act was passed by the English parliament under which the tremendous growth of companies and corporations has taken place both in England and in the rest of the world.

The company owes its vitality to the co-operative principle by which a multitude of small investors creates a fund to be used in the furtherance of a common object. This device has admirably served the purpose of absolutely and unmistakably determining the division of profits resulting from the joint action of those contributing to the fund.

The substitution of the company, which has been defined as a legal entity without a body to kick and no soul to damn, for a personal employer has, however, had certain tendencies which, when pushed to an extreme, have led to undoubted abuses on three classes of society. First, investors. Investors in a company with limited liability may entirely divorce the responsibility of how wealth is acquired from the actual possession of wealth. They thus tend to lose touch with their fellow-men. Second, managers are given great power with only a limited amount of accountability. Human nature cannot stand either too much prosperity or too much power and unless managers are called to account for their stewardship they lose their sense of proportion and their sympathy with their fellow-workers. Third, laborers: under company management, laborers tend to become cogs in a big machine and lose incentive to do their best. The human will is one of the most illusive of things, but the difference between having it work for you or against you is all the difference between success and failure. This fact has been most strongly brought to my attention by the statements of recent visitors from England who were interested in the labor problems there as they have been developing during the War. Statements were made by several manufacturers that partly-trained women who were keenly desirous of doing their best would produce from three to four times as much work as had previously been produced by skilled men who were only desirous of doing enough not to be dismissed.

Many methods have been suggested of correcting the above abuses which are admitted by most thinkers. Publicity of stock-ownership so that each individual shareholder could know who were his co-partners in any enterprise is one of the suggestions that seems to me to promise much toward placing the responsibility of the company's action where it belongs, that is, upon the stockholder. The requirement from the management of periodic reports to stockholders, giving a detailed account of their stewardship, will be corrective of many of the abuses of management. One of our largest corporations, the United States Steel Corporation, under the leadership of its chairman, Mr. Gary, has put in operation a plan for interesting its laborers in the success of the corporation by making them shareholders therein; this promises good results. Other corporations have found that their annual payroll was approximately the same as the capital necessarily employed in their business and the managements have decided that, after paying what they called the wages of capital—say, 6%, any profit above that will be divided equally between capital and labor, and thus so-called labor dividends are declared. A further suggestion for inducing the human will of the laborer to co-operate with the director in the success of an enterprise is the use of an employment manager. Considerable discussion has taken place on this subject and the results obtained in several plants have been reported to the Institute, but the suggestion seems to me fertile and capable of further expansion. We are no longer buying labor; we are selling employment, and our salesmanship is somewhat defective and must be improved. We no longer have a reservoir of idle hands from which to draw our laborers and the days of 'hiring and firing' are limited. Every man who is hired by a corporation is supposedly capable of working, certainly is desirous of working, and has the ultimate necessity of working in order to earn his living; therefore, it behooves us to find out where his capabilities can be profitably utilized and not merely allow the whim or temperamental objection of some foreman or the misunderstanding of the man himself to entail upon the company the large expense attendant upon the continual change of laborers.

I am one of those who think that the interests of capital and labor are identical, up to a certain point. They both want to produce wealth and they both realize that in order to produce wealth they must co-operate.

*Part of speech dilevered by the President of the Institute at Butte, Montana, on April 6, 1918.

It is only when it comes to dividing that wealth that their interests apparently diverge. For me, the ultimate basis of value is the emotion aroused in a person by the possession of the thing valued. Money is the most common, but it is by no means the only, yardstick by which the arithmetical expression of value can be made. If you have in one hand something that you value and a person offers you something else for it—be it either money, fame, renown, honor, or any other valuable thing in this world—you will take that which is offered you in the other hand and when that which is offered you arouses a greater emotion in you than that which you have, you part with that which you have and take that which is offered you. Recently a member of the Institute, and a friend of mine, came to New York and went through some of the large houses in New York where are accumulated treasures of our art, skill, and culture. He also went through, from top to bottom, many of the large department stores where goods of all kinds are gathered together to please the eye and mind and palate of men and women, and after seeing all this he came to the conclusion that the vast bulk of it was burdensome trash. Here is a state of mind with which we shall have to reckon when the War is over. We have got to realize now that much of what we now call wealth will seem to those returning men from the front nothing but burdensome trash.

Sit down with labor and its representatives and find out what it wants. Some of these men are reasonable; some are unreasonable, just as it happens in every other class. Don't let the laborer, partly for want of understanding on our part—we who form the captains, lieutenants, sergeants, and corporals of this great army of labor—fall into the hands of extremists who will lead him into every kind of mirage pictured by the Bolsheviki.

Mineral Imports at San Francisco

During the month of April, 1918, the following minerals and metals were entered at the port of San Francisco:

	Tons	Pounds	Value
Potash	....	480	$ 67
Potash salts	....	2,426	5,444
Sodium nitrate	1304	.....	47,773
Chemicals	....	.....	2,914
Chrome ore	1000	.....	11,000
Manganese ore	1035	.....	8,119
Tin bars	....	3,615,288	2,156,365
Tungsten ore	79	.....	108,765
Antimony	....	112,000	11,200
Lead ore (lead content)	....	108,187	995
Zinc dust	....	11,200	1,319

The total production of bauxite in 1917, according to statistics compiled by the U. S. Geological Survey, was 568,690 long tons, of which the Arkansas field produced 506,556 tons, and the Georgia-Alabama-Tennessee field 62,134 tons. Imports of bauxite amounted to 7760 tons, compared with 30 tons in 1916. The price of bauxite ranged from $4.75 to $10 per ton, and the average price was $5.48 per ton at the shipping point.

Industrial Development

By E. B. HOWELL

*In considering the probable industrial developments of the future, it will assist in clarifying the problem to consider what have been the industrial developments prior to the War. One hundred and fifty years ago the manufacturer was a person who made things by hand—by his own hands usually. He was the weaver by his loom, or the smith at his forge. If he prospered, he hired other workers who were called 'hands'. Why should they have been called 'hands' rather than 'heads'? For the simple reason that the boss was retaining the head-work, or management, for himself. The wage-earner was simply a hand. He was not expected or permitted to advise the management.

So long as the organization of industry was primitive and simple, this divorce between the manual worker and the management occasioned no trouble. The greater bulk of the population was agricultural anyway, and people living close to mother earth and directly deriving their sustenance therefrom have never bothered their heads with complicated industrial or social problems.

But with the invention of the steam-engine there came a great change in industry. The single loom was multiplied by hundreds. The forge was replaced by furnaces and steam-hammers. The manufacturer ceased to work with his own hands, and usually was a corporation. The number of hands employed was multiplied by hundreds and thousands. But there was one feature of the original primitive system that remained and has persisted to the present day—the manufacturer retained the management, the hands remained mere hands.

Several years ago I wrote an article for an Eastern journal entitled 'Labor v. Capital v. Management,' in which I tried to develop the thesis that management is a third element in the industrial conflict that should not be identified with either capital or labor. Often the capitalist has his grievance against the manager quite as well as the laborer. I think that if we bear in mind this third element of management, it will assist in clarifying the industrial problem. When one thinks of it, there is no reason in the nature of things why the people who furnish the capital to inaugurate an industry should manage it to the entire exclusion of those who have invested their manual skill therein. The latter have quite as vital an investment as the former. If the manual workers were in control and should tell the capitalist, a la Bolsheviki, that he was fired, that he could 'go chase himself,' or similar terms implying that his connection with the establishment was at an end, that capitalist, so fired, would have much the same feeling that a workman has who has been discharged from the only industry that he knows anything about, and perhaps faces the necessity of selling out his little home, and emigrating.

The industrial labor problem will never be solved

*Part of speech delivered on the same occasion as the preceding. Taken from the May bulletin, A. I. M. E.

until the right of the manual worker to share in the management of industry is recognized. It will never be solved until the wage-earner has some kind of a contingent financial interest in the enterprise. As it is now, there is continual warfare between labor-unions and their employees, sometimes suppressed only to break out again. The labor unions demand the highest possible wage, seemingly thinking that they are entitled to all that they can persuade or extort out of their employers, regardless of whether the business can stand it or not. Where the employer is compelled to pay the highest wage, he immediately recoups his loss from the general public, part of whom are the very wage-earners, by advancing the price of the commodity manufactured. The labor-union seeks only to get as much as it can of the fruits of the industry for as few hours' work as possible. It does not assume any of the burdens of making ends meet, of finding a market for this product, and of securing competent and faithful employees, that the employer has to shoulder.

The ordinary employer regards the efforts of the labor-union as an unwarranted interference with his own private business. He by no means recognizes the right of the manual worker to any part in the management of the industry. He has the feeling of the employer for centuries past: "I put up the money for this enterprise, I own it and have the right to manage it as I choose without interference."

The fallacy in this position does not appear where the employer hires only one or two hands. It begins to appear when he begins to monopolize a great industry in any particular place, and hires hands by the hundred or thousand. Then it begins to be apparent that he does not own the industry in the full sense of the term, that the State has an interest in the industry and in the welfare of the workers dependent on that particular industry for the livelihood of themselves and their families. When we recognize the interest of the State in industry, when we see that the workers who have acquired a manual skill therein have a real and substantial investment, then it follows inevitably that the exclusive management of industry by capital must some time have an end. Industry must become of the people and for the people just as surely as government itself.

After the War, I believe that labor will participate in the management of industry. I use the word "participate", because I do not believe the plan of socialism to exclude capital, or to exclude those captains of industry whom we call the management, will ever succeed anywhere, or ever even be tried in America. The Bolsheviki are giving an object lesson on this subject to the whole world. But the participation of labor in the management will solve the problems not only of labor but of capital. This participation will not come as a gratuity like so-called profit sharing. It will come as the manual worker's right—as the restoration to him of the birthright that unawares he lost when the steam-engine brought about a transformation of the industrial world in the 18th century.

I can imagine the keen highly trained manager at this point objecting: Must I associate with me in my work the unlearned, untrained, irresponsible, and sometimes dissipated men that come to me for work? Must I take orders from such men as these? And the capitalist may protest that his property should not be put at the mercy of employees. In every industry, there are probably employees who are unfit to participate in the management, but even their own comrades would not choose them for such a purpose. On the other hand, in every industry there are manual workers as intelligent, as fair-minded, and as just, as many of those now controling industry.

When labor acquires a contingent interest in industry it will be to the interest of the manual worker to help the enterprise to succeed. He will be an enemy of the slacker and shirker because the latter lessens his profits. He will be loyal, because loyalty will increase his own profits.

While I am sure some such change in industry is coming, I do not know just how it will come. Progress is wrought out quite as much as thought out. Perhaps it may come about by the creation of a new kind of stock for the corporations employing many hands, which one might call 'industrial' stock. Capital stock would go to the men furnishing the capital and industrial stock be set aside for those furnishing the manual skill and the brawn. Each kind of stock would have its representatives on the board of directors, and each would share in surplus profits. I use the term 'surplus profits' because there must first be paid out of gross earnings a reasonable interest on the money invested. These payments might absorb all the net earnings, but every successful corporation has its prosperous years when there is a melon to cut, and then the industrial stock would come in for its share of the extra dividends.

Popular government may not always have as efficient officers as autocratic government, yet none of us would for that reason want to go back to autocracy. What a democracy loses in efficiency it gains in a greater diffusion of well-being, and in the loyalty of the governed. An industry managed in part by its operatives may lose some of the cold-blooded efficiency of an industry managed by one autocratic mind, but if it ministers to the welfare of a greater number of people, if it substitutes loyalty for disloyalty, hope for despair, the honest toiler for the shirker, industrial peace for industrial warfare, then it marks progress.

INDIRECT TAXATION yielded $345,000,000 in England during the year before the War. Last year it produced a revenue of $510,000,000. The amount of direct taxes paid in the fiscal year 1913-14 was $465,000,000, and it rose to $2,330,000,000 last year. In other words, revenue derived from indirect taxation in 1913-14 represented 42% and that from direct taxation 58% of the total, whereas in 1917-18 indirect taxation yielded 18% and direct taxation 82% of the total. This means that the cost of the War was being paid by those enjoying surplus wealth.

Treatment of Manganese Ores

In a recent bulletin issued by the University of California, entitled 'The Possible Treatment of Manganese Ores in California,' E. A. Hersam, associate professor of metallurgy in the University, gives the results obtained in preliminary studies conducted under his supervision. These tests are of special interest at the moment. Electrostatic separation gave negative results, the silicious constituents of the ore being thrown into the concentrate to a serious extent, while the magnetic oxides failed, in part, to respond to the electrostatic force. Magnetic separation, however, showed considerable promise. Most manganese minerals yield to treatment on a Wetherill machine, and afford good products when fed with ore that has been closely sized. Classification by screening alone also effects considerable concentration. In an ore from Patterson, California, the 200-mesh material contained about twice as much manganese as the grade between 40 and 48 mesh. The treatment of the finer sizes by magnetic separators generally show a low percentage of recovery. The following table presents the results obtained by magnetic separation applied to the 40% grade.

	Weight of product, per cent of original ore	Mn in product, %	Mn content based on original ore, %	Per cent of total manganese in original ore
Readily attracted	9.9	38.7	3.9	12.1
Less readily attracted...	26.3	39.6	10.5	32.6
Least readily attracted..	32.9	40.2	13.4	41.4
Not attracted	30.9	14.6	4.5	13.9
	100.0	....	32.3	100.0

The indication is that a readily attracted hard high-grade material is present in the ore, and that a soft low-grade constituent, less strongly attracted, escapes with the tailing, thereby increasing its grade. In so far as part of this soft material is caught in the concentrate the grade of that product is lowered. Much of this softer constituent consists of pyrolusite and other manganese minerals containing silica, and inseparably mixed with the gangue in the process of dry grinding. Magnetic separation applied to carbonate ore showed a recovery of 96.7% of the manganese in a concentrate assaying 38.6%, leaving a tailing that held 3.3% of the metal that had been present in the original ore, which in this case carried 1.9%. Calcination of the carbonate ore resulted in a magnetic concentrate assaying 50.9% Mn, leaving 6% of the original metallic content in the tailing. It appears that the roasting and re-treatment of the tailing offers an opporunity to effect a high saving in the magnetic concentration of manganese ores.

Flotation proved unfavorable. Ores from Patterson and Davenport, California, were tested, using pine oil, crude pine oil mixed with tar oil, and crude petroleum, 14°B., from the McKittrick field. The Patterson ore, assaying 37.7% manganese, yielded, with the three flotative agents respectively (*a*) 18% of concentrate containing 34.3% manganese, (*b*) 30% of the weight of the ore as concentrate assaying 38.94%, and (*c*) a concentrate assaying 38% manganese and a tailing with 36.8% of the metal. The Davenport ore gave results equally unsatisfactory.

Gravity concentration, that is, with jigs and tables, is effective only when the minerals are hard and pure, and break free from the gangue. The fine material obtained by classification is difficult to concentrate by any method. Magnetic separation appears to offer the larger possibilities for successful treatment of ores of manganese.

Concentrating Lead Ores at Kellogg, Idaho

The Bunker Hill & Sullivan report for 1917 gives the following details of milling:

Mills working, days	356
Ore milled, tons	493,030
Ore milled per 24 hours, tons	1,386
Assay of feed, lead per cent	10.6496
Assay of feed, silver ounces	4.3170
Lead content, tons	52,506
Concentrates, tons	103,982
Assay of concentrates, lead per cent	45.1967
Assay of concentrates, silver ounces	16.2794
Lead in concentrates, tons	46,996
Lead recovery, per cent	89.51
Silver in feed, ounces	2,128,437
Silver in concentrates, ounces	1,692,765
Silver recovery, per cent	79.54
Cost per ton milled, cents	60
Cost per ton of concentrates	$2.846

THE GREAVES-ETCHELL electric furnace is of the 3-phase type, two of the electrodes being introduced vertically through the roof, while the whole hearth acts as the third. Three single-phase transformers supply the energy. Their primaries are connected in delta, and their secondaries in star with unequal legs, the proportion being so calculated as to give a balanced load on the primary mains when the upper electrodes are in equal adjustment. If one of the arcs breaks, the others are not affected and an overload on one arc is eliminated. Furnaces are made in standard sizes ranging from 10 cwt. to 10 tons. The smaller furnaces are rectangular and the larger ones circular in plan. An arrangement of compensating rollers allows the spout to travel downward in a vertical line, so that the ladle need not be moved.—'Electric Review', London.

THE STEEL INDUSTRY has been advised by the Committee on Steel and Steel Products to restrict the use of chrome ore for direct refractory purposes to a maximum of 1½ lb. per ton of open-hearth ingots; that it purchase for the above purposes only domestic or Canadian ores containing not to exceed 38% chromic oxide, nor more than 35% chromic oxide as an average, and that each carload be considered as a separate unit for analysis. The committee recommends that the use of chrome-brick and chrome-cement do not exceed the equivalent of a maximum of ½ lb. of chrome ore per ton of ingots. The Committee urges that every effort be made to find substitutes for chrome ore for refractory use in open-hearth steel-making, with a view to effecting the maximum possible reduction in the use of chrome ore, without curtailing steel production.

The Groch Flotation Machine

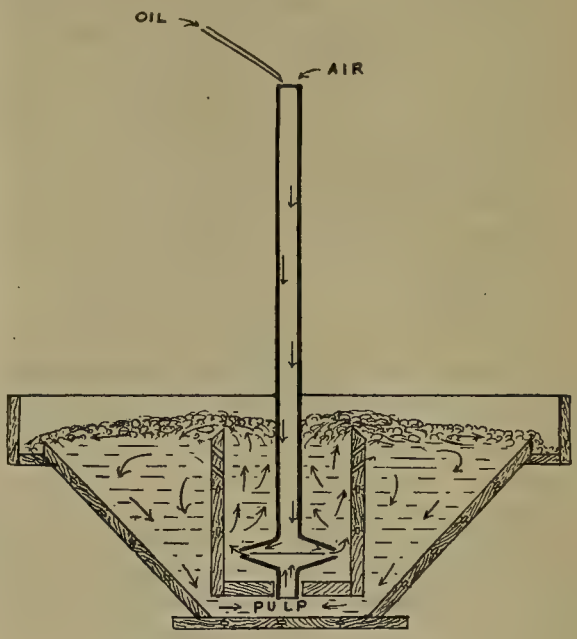
By F. O. GROCH and W. E. SIMPSON

*Flotation is of two classes: (1) the surface-film, or dry-ore class, in which the ore in a dry state, and crushed to the requisite fineness, is gently placed on the surface of slowly moving water, a separation being effected because of the tendency of valuable mineral particles to resist being wetted with water and to remain on the surface, while the valueless gangue particles sink, and (2) froth-formation, or the wet-ore class in which advantage is taken of the comparative ease with which the valuable mineral particles, already wetted, repel or shed the water from their surfaces under the mysterious influence of some froth-forming agent, generally an oil, and attract bubbles of air or other gas with which they may come in contact, forming, in the pulp in which they are immersed, a buoyant association which rises to the surface as a froth or scum. The Groch appliance is of the froth-forming type.

Froth-forming flotation machines may be considered as of two kinds, distinguished from each other by the method employed in bringing the air or other gas into contact with the flotative minerals. The pneumatic machines aerate the pulp under treatment through canvas floors, while the mechanical appliances perform the same function by means of impellers. The Groch machine is of the impeller type.

From the metallurgical standpoint, the best results are obtained when the three essential constituents of a flotation-froth, namely, the oil, the air, and the mineral particles, are all in a minute state of subdivision but, for commercial reasons, it is advisable to avoid excessive pulverizing of the ore, not only on account of the prohibitive cost, but also because of the difficulty of profitably disposing of an extremely fine product destined for the smelter. As regards the oil and air, however, no such disadvantage exists, the object of all flotation-machines being, in fact, to disperse and subdivide these to the greatest extent obtainable. In this operation the Groch system is especially efficient.

The Groch centrifugal flotation machine has a number of impellers operating in a 'V' box 14 ft. long by 5 ft. wide, and divided both longitudinally and transversely into compartments. By means of submerged and slotted partitions, the pulp during treatment is made to take a zig-zag course both vertically and horizontally in its passage through the machine. A cross-section shows three compartments; in the central one operates the centrifugal impeller, which is the chief distinctive feature of the invention. Each impeller is a vertical hollow shaft with a centrifugal 'runner' at its lower extremity, having hollow hubs and being subdivided horizontally by a metal disc so as to operate after the manner of a pair of centrifugal pumps. This class of impeller combines the functions of an emulsifier, an agitator, and an aerator simultaneously, thereby eliminating any necessity for auxiliary appliances, and making each individual machine complete and independent. When in operation the 'runner' is completely submerged in the pulp, while the hollow shaft, to which it is attached, is the medium through which the power is transmitted to effect rotation. The pulp enters the zone of treatment in the central compartment from underneath a false floor through which the lower hollow hub of the impeller protrudes. It is here sucked up into the interior of the lower section of the 'runner', and ejected centrifugally at the periphery in a horizontal plane, rising upward in the central compartment by displacement until it overflows into the compartments on either side. All round the zone of discharge, at the periphery of the 'runner', a vacuum



SECTION OF THE GROCH MACHINE

is created similar to that caused at the nozzle during the operation of an ordinary steam-injector. With the standard impeller it is found that the vacuum becomes measurable when the speed reaches 200 r.p.m., increasing to a degree equal to $2\frac{3}{4}$ in. of mercury at a speed of 450 r.p.m., and 6 in. at 750 r.p.m. Into this vacuum the content of the upper section of the 'runner' is drawn automatically, and, as this part of the impeller has its inlet from the top of the hollow shaft, the result is that an enormous supply of air is continuously ejected as a horizontal layer into the pulp. This air-layer, as it recedes from the centrifugal centre, must, because of its ever increasing diameter, eventually become so thin as to break into a shower of infinitessimally small bubbles. According to current theory, this is precisely what is wanted for the most effective work in flotation. Through the hollow shaft, also, oil is admitted drop by drop into the area of treatment, each drop falling from a height and, striking the rapidly revolving interior metal disc, becomes mi-

*Abstract: Canadian Min. Inst., March 1918.

nutely dispersed. To use a trade expression, the impeller is really an 'atomizer', reducing the air-bubbles to nearly molecular size, and spraying them with oil, thereby rendering them highly adhesive to the mineral particles with which they come in contact. If it be assumed, as is generally believed, that successful flotation is the result of intimate mechanical contact between the flotative mineral and the buoying agents, then, by this system, ample opportunity is given for repeatedly making such associations, for, at each impeller, the shower of minute air-bubbles forms, as it were, a horizontal barrage through which the mineral particles must pass on their way through the machine. An equal advantage might also be claimed if, on the other hand, it be assumed that the gas-bubbles, in order to be effective, must be nascent, or be generated from the solution, each mineral-particle becoming the nucleus for the creation of the bubbles in embryo. In the Groch system the air-bubbles, on being discharged from the impeller at depth, tend to become absorbed in the pulp to the extent of saturation at the pressure to which they are momentarily subjected. With this pulp traveling upward, the pressure becomes reduced, and consequently a state of super-saturation must be reached, with the liberation of nascent gas-bubbles. In any case it would be expected that the union of the gas-bubble and the mineral, under pressure, would be of a stronger type than if no such pressure existed. Once united, the association becomes increasingly buoyant on being brought toward the surface, for the reason that, when the pressure is thus released, the buoying gas-bubble increases in size through expansion, in accordance with well-known natural laws. The Groch machine eliminates the disadvantage, common to machines using the blade-type of impeller, of having to beat the air into the pulp by the creation of a deep vortex, a system wasteful of power and inefficient in operation. A study of the ordinary cream-separator leads to the belief that, with such a type of machine, the tendency is for the froth or 'cream' of the pulp to collect on the inner surface of the vortex, where it is not wanted.

As illustrating one of the best grades of product that the Groch machine can deliver, it may be mentioned that, in the case of a molybdenite ore treated experimentally, a concentrate was obtained assaying 99.34% MoS_2, a performance that leaves but little room for improvement. Furthermore it is claimed that, in the treatment of a silver ore at Cobalt, a 10 days' run with a Groch machine gave a 5½% higher recovery than that obtained with other systems; at the same time, the concentrate was of a higher grade. A low power consumption is also claimed, the standard machine, with six impellers, having a capacity of from 35 to 75 tons per day, depending on the class of ore being treated, showing a consumption of 7½ hp. by actual determination.

FREE ZIRCONIUM exists in three forms, namely, amorphous, crystalline, and graphitic. The crystalline form, with a density of 6.4, has a melting-point of approximately 2350°C. Only two minerals can be considered as commercial sources of zirconium: the natural oxide and the silicate. Natural zirconia contains 84% of the pure oxide, with 8% of silica and 3% of oxide of iron. Purified zirconia is a white substance with a density of 5 and, according to Weiss, a temperature of fusion of 3000°C. The first important application of the oxide of zirconium was as a substitute for the cylinders of chalk in the Drummond light. This oxide was employed in the manufacture of incandescent gas mantles, but was later superseded by thorium oxide, which gives equally good results at a lower temperature. Another application was effected in 1887 in the production of the Nernst lamp. Mixed with 10% of magnesia, with a binder consisting of starch, phosphoric acid, and glycerin or its borates, a product is obtained impermeable to liquids and unaffected by strong or fused alkaline mixtures. Its uses in metallurgy are promising. In trials of a Martin electric furnace in a steel works at Remscheiden, Germany, a lining of zirconia was found in good condition after a run of four months' service without repair.

Tin Deposits in Virginia

One of the most promising American tin deposits is in the Irish Creek district, in the eastern part of Rockbridge county, Virginia, near the summit of the Blue Ridge. This deposit was recently examined by H. G. Ferguson of the U. S. Geological Survey, acting in cooperation with the Virginia Geological Survey. Mr. Ferguson's report has been published as Bulletin XV-A of the Virginia Geological Survey. The existence of tin in the Irish Creek district has been known for many years. Between 1883 and 1893 the deposit was actively worked. The company, however, became involved in litigation over land-titles and abandoned the enterprise in 1893. Operation was never resumed, and the old workings are now caved so that a thorough examination is difficult, but Mr. Ferguson concluded that the deposits along the Blue Ridge in this vicinity offer some promise as a source of tin, both through the systematic working of the known veins and the possible discovery of other deposits. The cassiterite occurs in quartz veins that traverse a hypersthene granodiorite. The veins do not persist for long distances and their tin content is irregular. Some high-grade ore has been found, however, and some tungsten occurs with the cassiterite. A copy of the report may be obtained on application to Thomas Leonard Watson, director of the Virginia Geological Survey, Charlottesville, Virginia.—'Manufacturers Record.'

BINOCULARS and field-glasses are desired by the Navy Department, owing to the scarcity of such instruments for the use of officers. Individuals owning suitable glasses are requested to send them by registered mail to the Navy Department at Washington, or to the nearest naval recruiting station. A receipt and $1 will be sent by the Assistant Secretary of the Navy, and the instrument ultimately will be returned to the owners, if they survive the mishaps of war.

Concentrating Carnotite Ore

By K. L. KITHIL and J. A. JONES

*The principal deposits of carnotite (a radium and uranium-bearing ore), so far as now known, are confined to a well-defined area lying in the south-western part of Colorado and the south-eastern part of Utah.

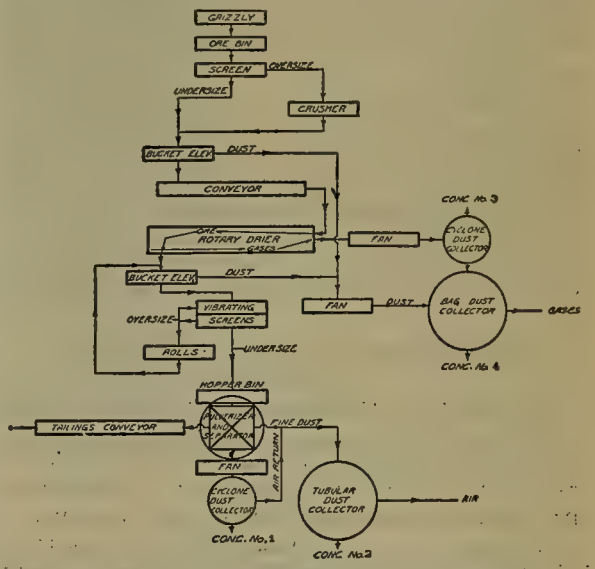
The milling operations to be described are those of the National Radium Institute. All of the claims worked by the Institute were leased on a royalty basis from the Crucible Steel Mining & Milling Co., a subsidiary of the Crucible Steel Co. of America. Of the claims leased, 11 were in or near Long Park, Montrose county, Colorado, 6 were in the Hydraulic district, same county, and 10 were in the vicinity of Sawpit, a station on the Rio Grande Southern railway, a few miles west of Telluride, San Miguel county. The last-named claims contain no carnotite, but vanadium solely. Of the carnotite claims, only those in the Long Park group were mined, all the ore required being obtained there.

At many carnotite mines it is the custom to sort both the ordinary shipping ore and the high-grade ore into several grades. At the Long Park claims of the Institute so-called high-grade ore was discovered in such inconsiderable quantities that no separate classification was made, except on the Maggie C. The ore was therefore sorted to two grades only: milling ore, running from 0.5 to 1.25% U_3O_8, and shipping ore, averaging 2%.

As carnotite partly forms the binder between the sand grains of the sandstone, it must be separated from these grains in order to concentrate it. Consequently the ore should be reduced to about the fineness of the sand grains. Care must be taken that as little as possible of the silica is ground to powder, as the concentration depends largely on the removal of fine or slime from the coarser material. Some of the carnotite adheres tenaciously to the surface of the sand grains and can be liberated only by attrition or elutriation. In order to concentrate the fine or slime, which contain most of the carnotite, either the wet or dry method can be used. In the former, advantage is taken of the difference in rate of settling of various sizes of the agitated material, followed by decantation and final settling of the slime, which forms the concentrate. Dry concentration suggests the use of air to blow or suck the fine from the coarser particles. A complete description of the dry methods used in the concentration mill of the Institute are given in the following notes.

It was found that after the ore had been ground to 80-mesh or finer all of the carnotite could not be entirely liberated by ordinary means. In order to save this carnotite a special attrition apparatus was constructed whereby the adhering carnotite was rubbed or scraped from the silica grains mechanically by passing the ground ore between a pair of discs, on one of which was a number of stiff wire brushes.

The course of the ore through the mill is indicated by the flow-sheet. The grizzly-bars were spaced 1¼ in. The larger pieces of rock were broken with a hammer. Waste was discarded. From the ore-bin the ore was fed mechanically onto a ½-in. screen placed at an angle of 45°. The oversize dropped into the crusher, the jaws of which were set to make a ½-in. product. The undersize dropped through a chute into the boot of elevator No. 1, as did the material passing through the crusher. The material discharged from the elevator was carried by belt-conveyor No. 1 across the building and dropped through a pipe into the feed hopper of the rotary drier. In passing through the drier the ore was repeatedly lifted by the shelves within and poured through the hot gases coming from the fire-box at the lower end. Considerable dust was liberated, which was carried with the gases and steam



FLOW-SHEET OF A CONCENTRATING PLANT FOR CARNOTITE ORE

into the smokestack. To save this dust all gases and steam were drawn off by the fan through the pipe connected with the smokestack and blown into the cyclone dust-collector. Through a pipe at the lower end of this collector the separated dust was drawn off. This dust formed concentrate No. 3.

Dust from carnotite ore has a relatively high uranium content, and is very irritating to the nose, throat, and lungs, therefore health consideration alone necessitated the use of fans and dust-collecting devices.

Considerable very fine dust carrying carnotite escaped through the opening at the top of the cyclone separator, and was blown through another pipe into the dust-collector, or bag-house. The dust so collected formed concentrate No. 4. The dried ore left the drier at its lower end near the fire-box and discharged into the boot of elevator No. 2. The hot ore was elevated to the vibrating screen, where the screw-conveyor distributed it equally over the screening surface. The oversize of both the ½-in. and 10-mesh screens fell through pipes into the feed-hoppers of the two sets of rolls; the undersize passed through a chute to the storage-hopper of the Raymond mill.

The oversize, after passing the rolls, dropped again

*Abstract from Bull. 103, Mineral Technology 11, U. S. Bureau of Mines, 1917.

into the boot of elevator No. 2, and was returned to the screen until all of it passed through the 10-mesh screen. The ground and dried ore from the storage-hopper was automatically fed into the pulverizer chamber of the Raymond mill, when the carnotite was separated from the silica grains, as already described. The tailing, which automatically discharged from the pulverizer, dropped onto the tailing conveyor and was carried to the dump. The tailing was practically free from carnotite dust.

The blower-fan connected with the boots of No. 1 and 2 elevators drew off the dust from these points, and blew it into the dust-collector already described. It is essential in concentrating carnotite ore by the dry method that all apparatus be so enclosed and connected with each other as to make the entire unit dust-proof, for all dust created in the mill contains carnotite and is part of the concentrate.

The relative proportions of the four concentrates obtained in operating the mill were approximately as follows: No. 1 concentrate, 88%; No. 2, 2%; No. 3, 7%; and No. 4, 3%. The ore averaged 0.85% U_3O_8, and the four grades of concentrates 2.91, 3.55, 2.76, and 3.44% U_3O_8, respectively. Tailing averaged 0.37% U_3O_8. The ratio of concentration was 6:1. The cost of concentration was $20.41 per ton, delivered at the mill warehouse.

Production of Phosphate Rock

The phosphate-rock industry, which suffered severely in 1915 and 1916 from the War, made a strong recovery in 1917. In spite of the shortage of railroad cars and fuel-oil that affected the output of the Eastern fields, the quantity of rock marketed last year, according to R. W. Stone, of the U. S. Geological Survey, was 2,584,287 long tons, valued at $7,771,084, compared with 1,982,385 tons, valued at $5,896,993, in 1916.

The output by States is shown below:

State	Quantity, tons	Value
Florida	2,022,599	$5,464,493
South Carolina	33,485	138,482
Tennessee, including a little from Kentucky	513,107	2,126,353
Idaho, Utah, and Wyoming	15,096	41,756
Total	2,584,287	$7,771,084

As a result of the falling-off of the foreign demand at the beginning of the War, our output of rock fell from 3,000,000 tons per year to less than 2,000,000 tons in 1915 and 1916. Before the War exports were nearly half the domestic production, but in 1915 they decreased from 1,250,000 tons, the quantity usually exported before the War, to only 250,000 tons, and were only one-seventh of the domestic production. In 1917 exports were 166,003 long tons, or only 6% of the quantity marketed. The rock exported went principally to Spain, France, England, Ireland, Scotland, Canada, and Cuba.

A notable feature of the year was the increase in production in the Western States, where there are now four producers instead of only one or two and the output was considerably greater than in any previous year. It is expected that the output from the Rocky Mountain phosphate fields will continue to grow, as the rock is high grade and abundant, and the demand for it should increase as the country on the Pacific slope is developed.

The demand on the United States to supply food not only for herself but for her Allies, in larger quantity than ever before, means intensive agriculture and the use of great quantities of fertilizers. Phosphate rock should be produced in 1918 in greater quantity than in 1917, and the output may approximate pre-War tonnage.

Alloys of Manganese

Manganese is used in the steel industry in the form of two alloys, ferro-manganese and spiegeleisen. These are both alloys of iron, manganese, and carbon. Ferro-manganese may contain as much as 80% of manganese, but averages in this country about 70%. In spiegeleisen the percentage of manganese is much lower; the standard figure upon which the price is based is 20%. The average manganese content is about 18%. Both alloys are high in combined carbon, the amount of which runs to 7%. The manganese alloys are added to molten steel from the converter, or open-hearth furnace, for the purpose of introducing both manganese and carbon. The manganese cleanses the steel by combining with the contained oxygen and, to some extent, with the sulphur, and then carries these impurities into the slag. The carbon is for the purpose of giving the steel the required hardness and strength. By adding larger amounts of the alloys, manganese steel is produced, which is noted for its hardness, tenacity, and durability. It is much used in the wearing parts of heavy machinery. In recent years the tendency has been to use more ferro-manganese and less spiegeleisen, on account of the much smaller amount of ferro-manganese that it is necessary to add to the steel. Spiegeleisen usually has to be melted in a cupola furnace before using, but ferro-manganese can be added direct. The latter also introduces less carbon, which sometimes is an advantage.

Ferro-manganese and spiegeleisen are produced by smelting a mixture of manganese ore and iron ore in an ordinary blast-furnace. A high temperature is required and the amount of fuel used is much greater than in iron smelting. A considerable amount of the manganese goes into the slag. The slag from a ferro-manganese furnace may contain as much as 10% of manganese. A considerable tonnage of the iron manganese alloys is now produced in the electric furnace.—Manganese Circular, Colorado School of Mines.

BARIUM CARBONATE is in great demand in England, where it is now selling as high as $170 to $196 per ton. Great Britain formerly depended on Germany for its supply, and it is said that the United States may permanently control this market if steps be taken to produce the precipitated carbonate in sufficient quantity.

BARYTES deliveries are greatly impeded for lack of cars. Spot prices average from $22 to $24 per ton for off-color grades, and from $28 to $36 for domestic, pure white, floated.

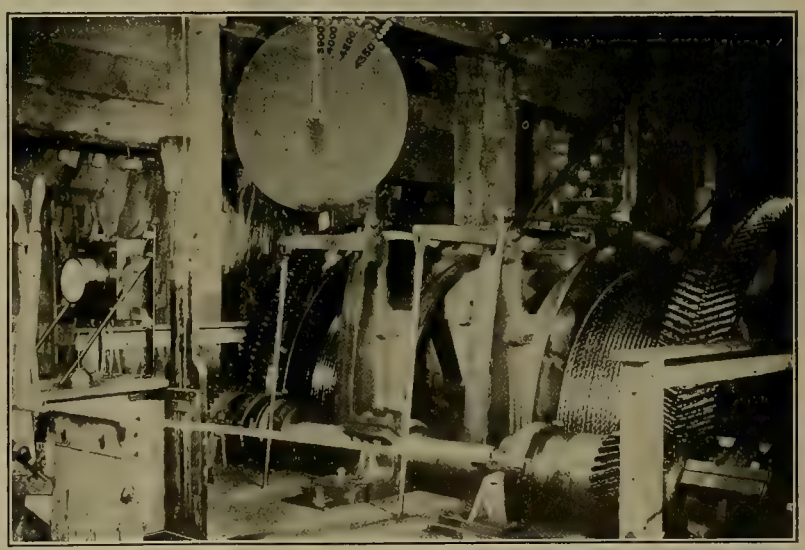
Hoisting by Stages From Deep Mines

By R. A. BALZARI

When a mine is producing ore and is being extensively developed below a vertical depth of 4000 ft. the hoisting problem becomes serious. The difficulties have been thoroughly studied on the Rand, in the copper country of Michigan, and in Europe. Without entering into technicalities, the question is whether it is best to use an engine capable of hoisting direct from great depths, or to hoist by stages, that is, with one engine at the surface and another, say, at 4000 ft., where ore-pockets filled by the lower hoist in turn fill skips of the upper hoist. The surface engine may be air, electric, or steam-driven, but the lower one can only be actuated by air or electric power.

ROPE-DRIVE OF UNDERGROUND HOIST AT ARGONAUT MINE, CALIFORNIA

In California there are some deep mines, notably the Argonaut, 4650 ft. deep on the incline; the Kennedy, 3950 ft. vertical; and the North Star, 6300 ft. on the incline. While no great quantity of ore is hoisted at any of these, the amount being about 500 tons daily at the Kennedy, yet the problems presented have been of interest, especially at the Argonaut. When this mine became so far developed that it was necessary to go deeper than 4500 ft., the engineers were confronted with the problem either of taking out the hoist at the surface and putting in a larger one, or of placing a relay-hoist at the 4000-ft. level to work in conjunction with the one at the surface. It became evident that if the surface hoist were taken out and a larger one put in, it would be necessary to cease operating for a considerable etim, owing to the fact that the only available point for the new engine was on the same foundation, this being due to the site of the Argonaut shaft with respect to the road and adjacent hill-slope. A 1⅛-in. rope is used. As the shaft is crooked and has a tendency to slip, it was found that a larger rope would be subject to wear, increasing the expense abnormally. Also, if the hoist were to work to a lower depth than 4000 ft., it would be necessary to increase the speed of winding, which the condition of the shaft would not permit. In other words, it would have been necessary to sink a new shaft if a surface hoist capable of



UNDERGROUND HOIST AT THE ARGONAUT MINE, CALIFORNIA

hauling from a depth of 7000 ft. were to be used; consequently it was decided to place a relay-hoist at 4000 ft. to supplement the hoist at the surface. It was also found that the cost of operating two hoists would be lower than working one large machine on the surface, taking into consideration the shut-down while the change from the present hoist at the surface to a larger one was being made. Moreover, it is found more satisfactory to conduct development work with a small separate hoist than to use the surface hoist for this purpose, the consumption of power being lower.

The hoist used at the surface was made by the Knight Engineering Co., of Sutter Creek, California, from a design perfected about 20 years ago, and is still giving good service. It is operated by a 500-hp. Westinghouse phase-wound induction-motor, which, in turn, is controlled by a liquid rheostat. The equipment on the surface is capable of hoisting from a maximum depth of 4500 ft., raising the skip and four tons of ore at a speed of 820 ft. per minute. This is a double-drum balanced-hoist.

The underground hoist is of the double-drum balanced type, built by Knight & Co. of Sutter Creek. The drums are 72 in. diameter and 27-in. face, with a single gear-reduction to the pinion-shaft in a 5:1 ratio. Mounted on this is a rope-sheave and brake-drum. The brake is of the post type, and is operated by a foot-lever from the operator's stand. The standard type of level-operated jaw-clutch is used on the pinion-shaft for throwing each drum into connection. The drums are also connected by hand-operated lever-brakes on the engine-man's platform. The hoist is driven by a 225-hp., type CW, 3-phase, 60-cycle, 220-volt, 495-r.p.m. Westinghouse motor. It is connected to the hoist by a continuous manila rope-drive, consisting of ten 1¼-in. ropes, kept taut by a tension-carriage designed by Meese & Gottfried of San Francisco. The control for this motor consists of a No. 1 liquid rheostat for the secondary and the type F magnet-switch control, which totally disconnects the motor from the line when the switch is opened as a primary control. Brass cooling-coils are used in the rheostat to prevent rapid deterioration due to acid that might be present in the mine-water, which is used for cooling and make-up. It is necessary to add a small amount of soda to make the correct density of electrolyte, owing to the natural salts in the mine-water.

The temperature at 4000 ft. ranges from 90 to 93°, and the atmosphere is quite humid. It is necessary to impregnate the coils of the motor against moisture, also all coils operating the electro-magnets on the switchboard, and all other parts likely to be affected by the dampness. After 17 months' operation there has been no trouble from this source. In case the plant is stopped for a considerable period, it is necessary to dry thoroughly all the switch-gear before starting, as the accumulation of moisture is inclined to cause trouble through leakage over the surface. The switches themselves during operation keep warm and dry enough.

The switchboard carries a circuit-breaker, and also a graphic recording watt-meter. Directly in front of the operator is a long-scale ammeter, which shows how much current is being drawn from the line, and enables him, in this manner, to regulate the acceleration and to keep the current drawn to a minimum. The operating cycle for this hoist is laid out on the following basis: The skips weigh 2500 lb., and carry 5600 lb. of ore each. The speed of the skip is 800 ft. per minute. The size of the rope used is 1⅛ in. The accelerating time is 20 seconds, retarding time 10 seconds, and loading time 30 seconds. Dumping is done during the time the skip-tender at the bottom of the mine is riding from the chute up to the station and getting off at that point, consequently no time is allowed for discharging. The amount of ore to be handled from the lower part of the mine is 300 tons per day, plus 600 to 800 tons of waste, and 50 tons of water.

A point of interest in maintenance is the fact that all the rope used on the lower hoist is taken from the engine at the surface. This is made possible by the fact that the rope, when operating over a depth of 4000 ft., will become worn to such an extent that it cannot be further utilized. It is quite safe for a considerable time on the underground hoist, and it is found that there will be enough rope obtainable from the surface to keep the underground plant in operation without the purchase of new rope for the relay-hoist.

This is probably the first 2200-volt motor to be used in hoisting at any considerable depth underground, and it is considered that this pressure will prove satisfactory. Every precaution has been used to protect employees against injury from the high voltage, which is taken directly from the bank of transformers at the surface and brought to the hoist by three conductors in a leaded and armored cable. The cable is of sufficient size, being No. 0, to allow of hoisting being started under a heavy load without a severe drop in the line-voltage at the motor.

The engineer at the Argonaut, V. S. Garbarini, arranged for and supervised the erection of this equipment.

HYDROLYSIS in a 0.1% cyanide solution, according to James Moir, does not in practice amount to more than 3.4%. These figures are based on a cyanide strength calculated as KCN. Other investigators have concluded that the hydrolysis amounted to 5.4%, while an earlier study by Mr. Moir had given an average of 2.4%. An elaborate investigation of the solution of gold in cyanide is being undertaken by Worley and Browne in South Africa, and this subject will receive more extended treatment by them.

BISMUTH is used largely in the form of bismuth salts for surgical dressings. Important amounts now go to waste in the smelting of lead and copper ores, the recovery of which is greatly desired by the Government. The imports have declined from a former high level of 164,793 lb. to 69,250 lb. in 1917.

MICA SCHIST containing large quantities of mica is resistant to high temperatures, and is recommended as a lining for furnaces.

REVIEW OF MINING

DENVER, COLORADO

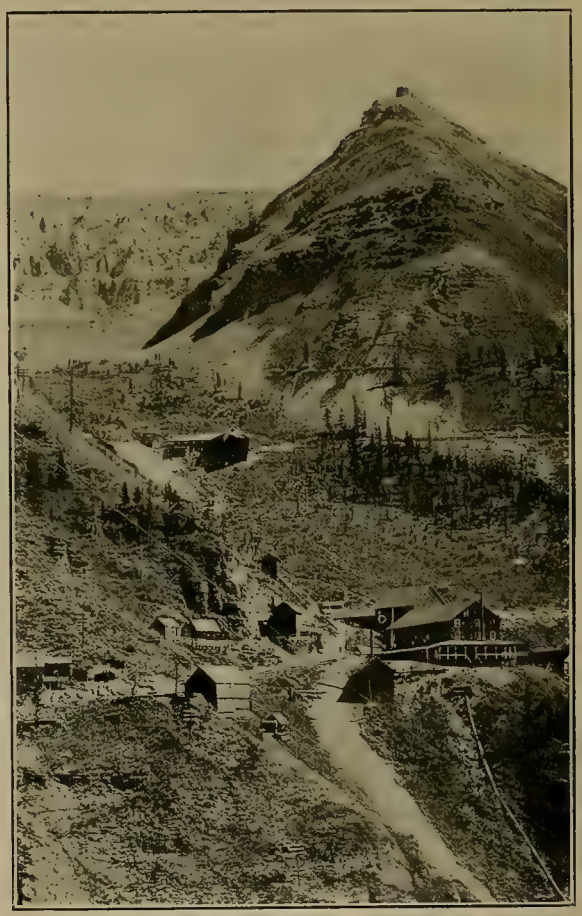
General Mining Situation.—Tungsten, Fluorspar, Silver, Oil-Shale.

A study of mining in Colorado leads to the conclusion that conditions are better than they have been for years past. There are persons who speak pessimistically concerning the status of mining (especially metal mining), but the fact remains that districts whose activities continued throughout the long period when low metal prices prevailed are now making unusually good showings, while old centres that could not resist the depressed prices have taken on new life that is indeed significant. There are few attempts to develop new districts or even to open new mines in old districts. When an investor who might undertake such things is approached he shies away from the proposal by saying that he prefers to put his money into a property whose merit has been proved by past production, even with correspondingly depleted reserves. Assumption of this attitude is explained in various ways. One excuse is that national conservation demands us to make every old worthy mine produce to its complete exhaustion. One man will explain that this is not a time for developing new districts because this might entail the extension of railroads. Another prefers to undertake operations in an old but equipped property because of the present difficulty in securing machinery. Although prospectors come to Denver with tales of discoveries in remote parts of the mountains, deaf ears are turned to their schemes, especially if the reported finds are of the precious or common metals. Notwithstanding attractive opportunities continually presented for engaging in operations in both old and new mines, interest certainly lags, primarily because of war conditions calling for the utmost conservation on the part of investors whose readily available cash resources are held at the call of the country. To such men the idea of large profits is not nearly so attractive as it was prior to the start of income and excess-profits taxation. Furthermore, recoverable profits from mining are not now measureable by the relatively high prices of metals. Enhancement in metal prices is more than discounted by the scarcity and high price of labor, supplies, and increased freight rates.

All of us recently have probably heard more or less grumbling from goldfields. The Cripple Creek 'Times' calls upon Federal legislators to do either of two things, namely, to place a war-time premium of $10 per ounce on gold or to arbitrarily fix its permanent price at $30 per ounce.

The tungsten market has received serious discussion in this State. The recent visit to Denver of the Federal Tariff Commission brought out many vital points relative to the future of tungsten mining in Colorado. The opinion prevailed generally among operators of these mines and reduction works that Congress should promptly fix an arbitrary price or an import duty, or should devise some other scheme whereby tungsten products could be always saleable at approximately $35 per unit.

One mineral that is actually bringing one of our old and formerly prosperous districts back into notice is totally different from the one that was first mined. A trip to this former gold-producer—Jamestown—impresses one with the importance of mining fluorspar, the latest mineral. The road between 'Jimtown' and Boulder is lined with auto-trucks that, two or three years ago, ran over the road between Nederland and Boulder with tungsten ore. Most of the fluorspar from the district is purchased by one Boulder company that operates a concentrating mill, in which the ore is raised in grade from 82 to 98% CaF_2, after which it is shipped to mid-West and Eastern consumers. Fluorite is being mined also at Evergreen in Jefferson county. Prices



THE SMUGGLER-UNION MINE, TELLURIDE, COLORADO

at the mines average around $6 per ton for 70% ore, with 20c. per unit above or below this. It is reported that a new company is about to take over the Wano gold mill at Jamestown, and purchase custom fluorspar ore upon a schedule starting with $3 per ton for 50% grade, and an additional 20c. per unit above. This is substantially better than the present schedule, and indicates a strong tone in the fluorspar market. The fluorspar at Jamestown occurs

in veins, with various strikes and dips, in a great mass of porphyry.

Despite rising expenses in mining, there is an unmistakable interest in silver. Reliable reports of renewed activities come from Silver Cliff, Creede, Silverton, Ouray, Crismas, Caribou, and Ward. In these districts, abandoned mines have been or are being re-opened. The Bassick, at Silver Cliff, is to be equipped with a 100-ton flotation plant. This mine has long been a geological curiosity, the ore occurring as cementing material for gravel in an extinct vent or geyser. In addition to renewed production from the Equity mine, Creede is expecting big things from the Monon group, an old property that was about to enter the shipping list when the general depression of the 'nineties struck the district. Officers of the Monon Mining Co. are: George C. Manley, president; August Drumm, vice-president; Theodore H. Thomas, secretary-treasurer; and Thornton H. Thomas, attorney; these last two men being known in Colorado as the 'Thomas twins.' From the Silverton district comes news that the old Peerless San Juan mine, in Minnie gulch, is being revived, after years of legal entanglement, by the Caledonian Mining & Milling Co. New machinery will be erected in the mill that was operated for a brief run years ago. Boulder county, too, is enthused about silver mining. H. F. Corfield, in developing the Congo Chief at Caribou, has exposed an 18-in. shoot of ore assaying from 250 to 400 oz. in silver. Alongside of this shoot is a 2-in. streak of argentite assaying up to 3290 oz. silver per ton, the metal associated with galena. The White Raven mine near Ward continues to produce high-grade silver ore from the curious stockwerk whose genesis has never been satisfactorily explained. At Crisman, the Yellow Pine has passed into the management of J. W. Pherson of Cripple Creek. He proposes to introduce more intensive mining among the 18 sets of lessees. This mine, for which its original owner once refused a million dollars, has been a small but consistent shipper since its location in the 'seventies, and we expect to hear of even better production.

The writer was agreeably surprised, during a recent trip, to see that the old Golden Age mine, at Springdale, Boulder county, is being worked. In this property there exists a system of parallel fissures traversing a mountain of mineralized porphyry. Operations ceased at this mine when the buildings were burned in 1897. In general, the ore is a low-grade gold-bearing sulphide, and is being concentrated in the old Standard mill at the foot of the mountain along James creek.

More interest is maintained in oil-shale, probably, than in any other new branch of Colorado mining. This is said advisedly. Showings in the field do not indicate any special progress, but the fact remains that actual construction of plants is withheld simply pending the selection of processes and equipment that will be reasonably sure of accomplishing success upon a commercial scale. This is a new industry for Americans. There are no operating oil-shale plants in this country from which to compile data as to treatment and costs. It is understood that at least one strongly-financed company proposes to put in a modified Scotch system in the DeBeque field, but the majority of operators appear to doubt the adaptability of foreign systems to our Western shales. Numerous American ideas are being developed, their progress being carefully watched.

CRIPPLE CREEK, COLORADO

Gold Output and Dividends.—Ore-Treatment Charges.

Production of the district in June was as under:

Where treated	Tons	Average value
Golden Cycle, Colorado Springs	30,400	$20.00
Smelters, Denver and Pueblo	2,500	55.00
Portland, Independence	36,350	2.46
Portland, Victor	13,880	2.15
Vindicator, Cripple Creek	19,800	2.10

The total was 102,930 tons, valued at $1,006,343. Dividends were paid by the Cresson, $122,000, and Golden Cycle, $45,000.

The Portland company has announced the following rates for treatment of ore at its Independence mill, effective July 1:

Value per ton	Charge per ton
Up to $3	$2.00
$3 to $3.50	2.25
$3.50 to $4.00	2.50
$4.00 to $4.50	2.60
$4.50 to $5.00	2.75
Freight on above grades	0.60
$5 to $8	$2.00 to 5.00
Freight on above grade	0.90

The Golden Cycle company announces the following new schedule for treatment at its plant at Colorado Springs:

New rate per ton	Old rate per ton	New rate per ton	Old rate per ton
$3.25	$3.00	$6.90	$6.50
4.25	4.00	7.50	7.00
5.25	5.00	8.60	8.00
6.60	6.00		

The Roosevelt drainage-tunnel was extended 79 ft. during June. The flow is now 3480 gal. per minute.

Armed guards accompanied two box-cars of ore from the Cresson mine to the Golden Cycle mill on July 2.

PLATTEVILLE, WISCONSIN

Review of Important Events in the Zinc Districts.

Highland.—The New Jersey Zinc Co. is operating the two Clark mines successfully. Wages were increased generally at the beginning of the month 25c. per day.——A new mine was developed on the Hying farm, one mile west of Clark No. 2. Drills were working on land adjoining.——The Saxe-Lampe Co. reduced its working force from 25 to 7 men, and kept going to keep its mine dry and raise a little ore. Six mines with mills however were idle in the first half of June.

Montfort.—Local mining interests started seven drilling squads prospecting for pyrite one mile west, where large deposits are known to exist.

Linden.—Indianapolis mining men purchased the Spring-Hill mine and mill for $6500. Operations were resumed, a shaft being sunk to ore. New ore was found last autumn by drilling.——The Lucky-Six No. 2 of Milwaukee started the Vial mine on the first of the month. It was recently equipped with a 150-ton mill.

Mineral Point.—The Mineral Point Zinc Oxide Works is working full time. Sales of the product have been light this season, and the warehouse capable of housing 50,000 bbl. is overflowing, so additional storage capacity has been provided. Sulphuric acid shipments are made from the acid plant daily. The two zinc-ore separators operated here on crude zinc concentrate turn out from 600 to 800 tons of high-grade blende weekly.

Mifflin.—The Vinegar Hill Zinc Co., operating two producers, the Yewdall and Senator mines, is engaged in a large exploratory program. A new mine has been developed on the Franklin Rundell farm. Ore is to be trammed to the main mill on the Yewdall. On the Dale Rundell farm another big deposit of zinc has been opened, and a new zinc concentrator is being erected. On the Albert Rundell farm, the same 'range' extending across country has been traced by drills, so the prospect of an additional producer is good.——Other good producers here are the Coker and Big Tom mines.

Platteville.—This district is practically shut-down, no shipments of ore coming from the Block-House, New Rose, or Mann & Harding mines. At the first named there was held on June 15 about 4000 tons of concentrate and separator product.

Cuba City.—The usual heavy receipts of raw ore at the

National Separators from Vinegar Hill mines has dwindled considerably, dropping from 20 to 8 cars weekly.——The Linden Zinc Co., another ore-separating concern, was being supplied with raw ore from the Frontier mines. Shipments of high-grade finished ore fell to about 60% of normal.——The Connecting Link Mining Co. completed a new mill and started it about the middle of June.

Benton.—This district is the one bright spot in the region, the output and deliveries being over 2000 tons of concentrate weekly. No mine development was reported; mine equipment and building was brought to a standstill. Prospecting with drills continued at a brisk pace, nevertheless.

Shullsburg.—Three fairly good zinc mines operated steadily here and shipments are regular.

Hazel Green.—The only producer to continue shipments from this district is the Kennedy mine, completing 25 years of active work.——The newly-equipped Jefferson mine was unable to get onto a producing basis on account of a heavy overflow.——The Monmouth Mining Co., shut-down a year ago, resumed operations.

DILLON, MONTANA

Mining and Placers in Madison County.

Dillon.—The old Pilares mine, about 40 miles west of here, is again being worked, employing 35 men. Several years ago, H. Armstead spent between $300,000 and $400,000 erecting a smelter, etc., but production was practically nothing.

A. H. French is leasing and shipping some lead-silver ore from the Argenta, 11 miles west of Dillon. A few other lessees are working.

Smith and partners are working a graphite mine, 15 miles south-east of Dillon, shipping a car per month of high-grade ore, which goes to Bethlehem, Pennsylvania.

The Beaverhead Oil Co. is drilling out from Dillon about nine miles south-west. The shales are said to be favorable.

Some work is being done on a new manganese property, 10 miles north-east of Dillon, at the 'Hogback.'

Bannack.—The two mines here are practically idle. A large mill was erected last year and much work done, but something went wrong.

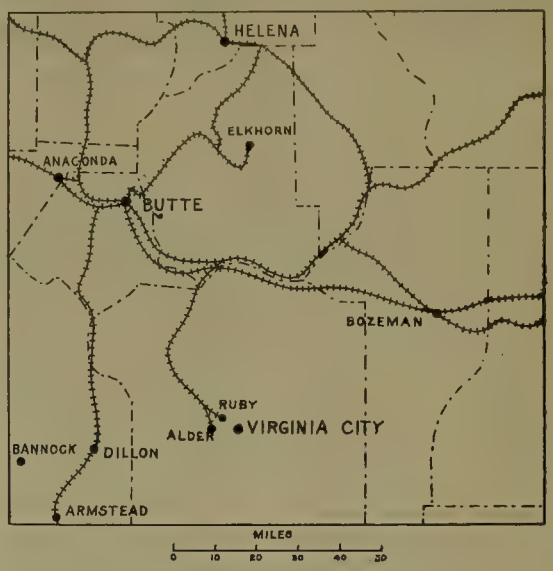
A lessee at the Delmonte lead-silver mine, near Bannack, recently shipped a car of ore.

Virginia City.—The Conrey Placer Mining Co.'s operations at Ruby, and above on Alder gulch for five miles, are about finished. There is 18 acres on the north side, just above Ruby, yet to dredge; this is about all. Bedrock is low; they are now filling the pit to float and operate a dredge. The ground at the upper end has reached the area where it was all drift-mined years ago. Alder gulch, where dredged, seems to be from 100 to 200 yards wide. Above the last dredge it has been placer-mined for seven miles. The dredges are driven by electric power. Their costs have been just under six cents per cubic yard, and the average value of the ground at the lower end, four to eight miles down, has been 16c. per yard, according to Government report (U. S. Bureau of Mines Bulletin, abstracted in the 'Press' of September 23, 1916). Operations have been very profitable. The round boulders are not large and are easily handled. They appear to be much less worn at the upper end of the dredging area than lower down. This does not indicate a glacial deposit as its origin (as sometimes claimed), nor is there any other placer ground found of any account, outside of this small, narrow, long gulch. The country rock is largely gneiss with limestone and some porphyry.

It is claimed that the records of Wells, Fargo & Co. show that $105,000,000 worth of placer gold was shipped out of Alder gulch by them in the early days.

The Eastern Pacific, up toward the head and west of Alder, has had a large production (largely silver) for 25 years. The owners are now cyaniding the tailing. The Highup, nearby, is said to make a good showing, now under option to Salt Lake City people.

The Missouri, a few miles east and north of Virginia City, has been shipping high-grade gold-silver ore for years. It now has a mill about ready to start. It is owned by Ellings & Pankey. From the numerous known veins it would appear that the old district of Virginia City should 'come back.' It is pretty country, well watered, and with a railroad five or six miles below Virginia City (the county-seat of Madison county), a branch of the Northern Pacific from Whitehall.



MINING DISTRICTS IN MADISON AND BEAVERHEAD COUNTY DISTRICTS, MONTANA

VICTORIA, BRITISH COLUMBIA

Rare Minerals Included in the Mineral Act.

The Mineral Act of British Columbia has been enlarged by Order-in-Council to apply to tungsten, fluorine, vanadium, radium, and uranium, or any combination of these elements "with themselves, or with any other elements." This action was taken by the Provincial government on recommendation of the Hon. William Sloan, Minister of Mines. It having been brought to the attention of the Provincial Department of Mines that there are occurrences of fluorspar and of scheelite here, it was decided to lose no time in bringing these and other minerals, heretofore outside the scope of the Act, within its provisions. It may be stated by way of explanation that the Provincial Mineral Act, and its definition of mineral, was drafted 20 years ago when the minerals in question were unconsidered, so that they have been in the anomalous position of being unstakable under the Act in a legal sense, although common sense and the necessities of the times demanded their inclusion. Incidentally it is pointed ou that the British War Board has asked the Canadian government to produce as much vanadium as possible, while the need of tungsten is also great. Not an inconsiderable market for fluorspar exists at the smelter of the Consolidated Mining & Smelting Co. at Trail.

Grand Forks.—The Consolidated Mining & Smelting Co. is said to have acquired under bond a large fluorspar deposit situated 20 miles north of this place.

ALASKA

Cordova.—The Chilty Oil Co., operating in the Katalla field, brought in a good well on July 5.

ARIZONA

Jerome.—On June 28 a committee, said to represent the Central Labor Union of Jerome, presented a demand to the Verde District Mine Operators Association for an increase in wages amounting to an average of over $1 per day each for all mechanics and laborers employed in and about the various properties and plants in the district. However, the demand was for an increase of only 10c. per day for shovelers. The committee intimated that if such increases were not forthcoming by July 1 there would be a general walk-out of all employees. The demand was refused by the Operators Association in a formal reply, and the Secretary of Labor, Wilson, was informed by wire as to the nature of the demand and the refusal, and requested to send at once a Federal Mediator to the district to adjust matters. From all reports it would appear that the movement has been put over by three or four of the extreme radicals here, and, although the rest of the men may be timid of continuing work in case a walk-out is called, the sentiment for the most part seems to be in favor of being loyal at this time, and stand by the agreement to abide by the decision of the Federal representative.

Miami.—On August 15 the Miami Copper Co. pays $1 per share. This makes $3.50 for the current year.

Oatman.—The United Eastern produced 9000 tons of $26 ore during June, yielding a profit of $165,000. This is the largest output since the mine started operations. On July 26 the company pays 5c. per share.

Walker.—The Lacey-Pabst company, former operator of the Union mine at Chaparral, has transferred its men to the Mud Hole gold mine at Walker. The first work will be to re-timber an old 80-ft. shaft where gold-silver ore was found; also the removal of an electric hoist from other workings to this shaft. W. J. Casey is in charge. The Mud Hole has produced more than $325,000 from shallow workings previous to the I. W. W. strike 10 years ago.

Silver-sulphide ore assaying over 200 oz. silver and $48 gold was opened in a 30-ft. shaft by W. McLeod last week. The vein is 4 ft. wide and the high-grade streak 8 to 12 inches.

Development has been gratifying at the old Milliken mine on Spruce mountain, one mile from Walker. An old tunnel opened shows 125 ft. on a vein assaying from $8 to $48 in gold and silver. A new shaft is being sunk and shows rich ore.

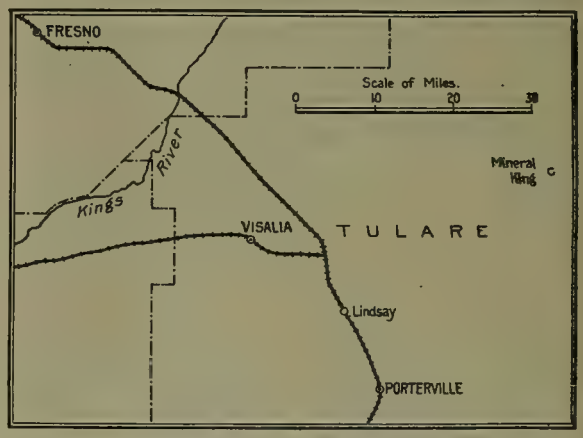
The molybdenum property owned by J. T. Burris and others is exceptional. The pay-streak is 18 to 30 in. wide, and assays by H. E. Woods & Co. of Denver show 3.6 and 4.9%. The No. 2 prospect is opened by a 125-ft. tunnel cutting the vein at 45-ft. depth, also by a 50-ft. winze in ore all the way. Some bunches show almost pure metal. The molybdenite is well disseminated and not in seams.

Placer mining along Lynx creek by C. H. McDonald has been suspended because of inadequate water supply. He will devote his attention to some lode claims. The clean-up was satisfactory. A number of $3 to $6 nuggets and much fine gold and amalgam are being saved. Lnyx creek, according to Government statistics, has produced over $5,000,000 in gold. When water is available it is not an uncommon sight to see citizens and even school-children digging and panning.

The Black Diamond mine operated by Irving is now producing. Veins of gold-lead-silver ore, 24 to 36 in. wide, worth $55 per ton, have been opened on the 100 and 200-ft. levels, with drifts 50 ft. each way. Sinking is under way to 300 ft. The property is equipped with 35-hp. hoist, steam-boiler, pump, and shops. There is 75 tons of ore ready for the next shipment.

CALIFORNIA

Porterville.—Magnesite mining in this district is still at a low ebb, and likely to continue so. A large deposit of feldspar was found recently on the Entriken property, 18 miles east of here. The orebody is on a steep hillside, and



PART OF CALIFORNIA, SHOWING SITUATION OF PORTERVILLE

is hauled on sleds to the bottom of the hill, then taken to the Globe station on the P. & N. E. line.

Sacramento.—In the dispute between William Hales and the Central Pacific Railway Co., defendants, and the Power Timber Co., assignee, the Land Office here has decided that miners may file mineral claims to railroad lands in California found to contain chrome. The decision has been sustained by the Federal Commission.

San Francisco.—Method of planning oilfield development is to be the subject of discussion at a public meeting called by the State Mining Bureau at the Engineers Club, 57 Post street, on July 15, at 2 p.m. This is the second of a series of meetings arranged by the State Mineralogist, Fletcher Hamilton. The first, held at Los Angeles for the purpose of discussing drilling methods involving the use of mud fluid, was well attended.

Yreka.—Hugh McKinnie, of the Ora Grande Mining Co., associated with local people, announces that they will open chrome sampling works and an assay-office at Yreka, to buy

and ship ore for the outside market. It is estimated that there is a large quantity of available chrome ore within 50 miles from the shipping point.

COLORADO

Breckenridge.—To test an ore carrying lead, zinc, gold, silver, and bismuth, owners of the Royal Tiger mine (J. A. Traylor, principally interested), have erected an experimental plant.

Durango.—One of the most interesting mining operations in south-western Colorado is that of the Cumberland Mines Co., leased from W. B. Ritter by R. R. Selway and W. Goff Black. The syndicate has strong backing. C. B. Miller is in charge. A shaft is being sunk on the vein to the Carboniferous area, which at the Cumberland is only 300 ft. from the porphyry. As there is no part of the district that is in the Carboniferous formation in which the Rico ore is found, this is attracting the interest of geologists acquainted with the La Plata mountains. The Cumberland has two strong veins carrying rich ore. Both have been slightly worked in previous years, and indications are favorable.

Leadville.—Manganese producers here are not satisfied with the new prices for their product, especially on ore carrying less than 35% Mn, as brokers make low offers for this. There are few mines here that yield ore of better grade.

The Leadville Unit of the U. S. S. R. & E. Co., after 30 months work in charge of H. S. Lee, has decided that Fryer hill does not justify further expenditure in development and pumping. Large sums have been spent at the Harvard, Jamie Lee, and Tip Top shafts. Results were discouraging. About 75 men were employed. The plants are to be dismantled.

GEORGIA

Chestatee.—The Chestatee Pyrites & Chemical Corporation has completed the construction of its 10-mile standard-gauge railroad to Clermont, Georgia, and its 600-ton sorting and concentrating plant. Underground development has shown an important deposit of iron pyrite. Production will start some time in July. The company has its own hydro-electric power-plant and a large townsite with comfortable houses for employees.

IDAHO

Bonners Ferry.—The Deer Creek Mining Co.'s gold property in the Buckhorn district of Boundary county has been sold to Montana people for $30,000. Conrad brothers, bankers of Montana, are interested.

Gilmore.—The Pittsburg-Idaho, Gilmore, and Latest Out companies are employing 50, 15, and 40 men, respectively. All three are shipping ore to smelters in Utah, and are reported to be in good condition.

Kellogg.—The Constitution M. & M. Co. on Pine Creek is to resume work now that the O.-W. R. & N. Co. is to complete the railroad. The mill is to be re-modeled and enlarged to 200 tons capacity.

Mackay.—On July 1 the Empire Mines Co. paid 5c. per share, equal to $50,000. This makes $100,000 for 1918, and $500,000 to date.

KANSAS

Treece.—A mile west of this place the Redskin Mining Co. is to erect a 300-ton gas-engine driven mill. Rich ore has been opened at about 50-ft. depth. F. R. Bouldin is general manager.

MICHIGAN

Houghton.—At No. 20 level the Ahmeek shaft is in a badly-crushed ground, entailing heavy timbering. The present depth is 2799 ft. A good deal of mass copper is coming from No. 2 shaft.

At the Quincy mill, concentrate bins have been enlarged and a foundation has been put in for No. 4 stamp.

MISSOURI

Belton.—Oil and gas possibilities in the Belton area, in Cass and Jackson counties, are discussed by M. E. Wilson in a recent bulletin of the Missouri Bureau of Geology and Mines. The region lies in a direct line of strike, northeast from the shallow pools of Kansas, and no doubt careful mapping will show similar structures along the strike line. A number of small oil and gas wells have been drilled. Possible variable sand conditions, and the presence of faulting and intense folding over part of the area inject an element of uncertainty as to results.

Joplin.—Mines in this district were closed from July 3 to 8 in order that the large reserves of concentrate might be reduced, also that miners could go to their farms for a few days.

MONTANA

Butte.—Davis-Daly made a profit of $59,973 in May. This was from ore mined in the Colorado. The flow of water in the Hibernia is easing considerably.

The Anaconda company has raised miners' wages 50c. per shift. This equals about $3,000,000 per year additional.

Elkhorn.—The Boston & Montana Development Co. reports as follows for 1917:

Expenditures totaled $443,969, including $217,528 for development and equipment, and $213,315 for railroad construction. Cash assets amount to $117,199, and accounts payable $44,079. To bring the property to the productive stage it is proposed to increase the capital from 3,000,000 to 5,000,000 shares, $5 par.

The general manager, J. D. Pope, reports that mining was confined principally to the 1000-ft. level of the Elkhorn mines. The advance was 3125 ft. This was largely in opening the Idanha vein along its course and the Park vein west of the fault-fissure. The Idanha maintained its average width of 20 ft. Where cut, the Park vein is 61 ft. wide, somewhat affected by the fault. In 300 ft. driven the width was reduced to 30 or 40 ft., assaying $20 per ton in gold and silver. Some rich shoots carried 10 oz. silver, 2% copper, 7% lead, and 50c. gold. Estimates of ore in both veins give between 600,000 and 800,000 tons.

On the railway between Divide, on the Oregon Short Line, to the Elkhorn mines, 35 miles, 90% of the grading has been done, 75% of the ties cut, and equipment purchased. The gauge is 36 in., and the line can handle 2000 tons daily. No work was done on the 500-ton mill, pending completion of the line, but foundations and buildings will be constructed before the road is complete to bring in machinery. Although the company can develop hydro-electric power, on account of difficulty in securing plant it has been decided to construct a transmission-line from the Montana Power Co.'s plant on the Big Hole river, 31 miles away.

NEVADA

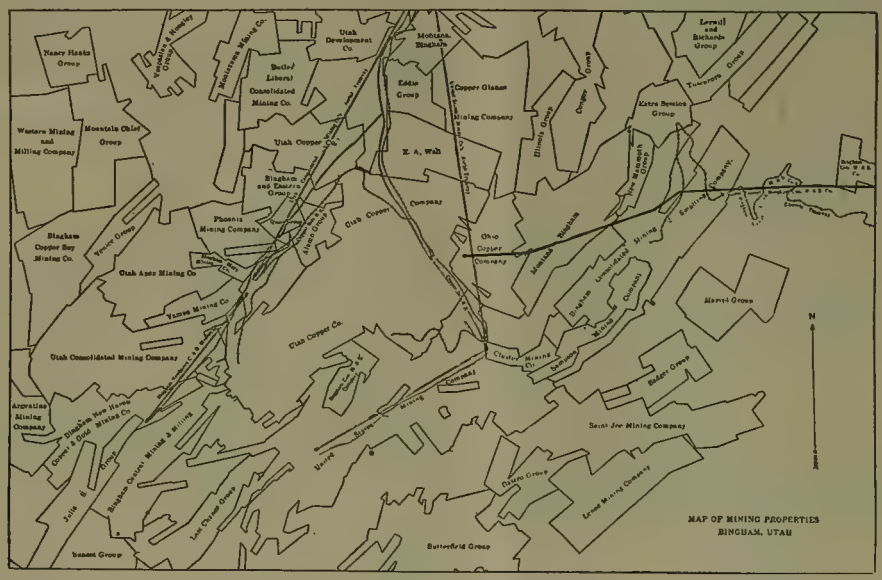
Ely.—The old Silver Eagle mine has been purchased by W. S. Bennett and others of Cody, Wyoming, while the Taylor mine has been taken under option by the same interests. Both properties are lead-silver producers, and are 16 miles south of Ely. Ore worth $1,000,000 is estimated to be available.

Goldfield.—The strike here may be settled by the contract-bonus system being started by the Goldfield Consolidated.

Manhattan.—A consolidation between the White Caps and Manhattan Consolidated is being negotiated. Developments in both mines are said to be very satisfactory. The White Caps mill is working regularly. A new Gould triplex pump has been installed on the 400-ft. level of the Consolidated.

Tonopah.—The Belmont company states that at the end of May the net income for the quarter was $186,553. Available resources were $294,002 from smelters, $156,286 from others, and $233,943 cash in banks. Disbursements in respect of subsidiaries to May 31 were $1,296,872 to the Belmont Surf Inlet, B. C.; $396,896 to the Belmont Shawmut, California; and $331,203 to the Belmont Wagner, Colorado; a total of $2,024,971.

The Tonopah Divide, at Gold Mountain, has sunk its shaft to 350 ft. Fifty tons of ore has been sent to the Goldfield Consolidated mill at Goldfield. It is said that the ore contains molybdenum.



UTAH

Alta.—The railroad into this district is now in good order and many mines are shipping ore to smelters. The South Hecla is sending out up to 125 tons per day. The Michigan-Utah is averaging a carload daily.

Bingham.—The Bingham Amalgamated is to resume work on the Lark side of its property.

From the 'Boston News Bureau' is abstracted the following: The never-ending question of apex rights has again turned attention to the Bingham district, between the Utah Apex and Utah Consolidated. On the side-lines sits the Utah Metals & Tunnel Co. awaiting a decision between the two that it, too, may enter a claim. Utah Apex last summer discovered the largest ore deposit that had ever been found in its property. This was between the 1500 and 1800-ft. levels and was rich in lead and precious metals. It is said that from this orebody Utah Apex has added substantially to its surplus cash that on January 1 last totaled $1,200,000. Since the first of 1918 the company is understood to have been earning net profits of from $75,000 to $100,000 per month, most of which was taken from this newly discovered vein. Now comes the Utah Consolidated, which has entered suit against the Yampa Copper Co., claiming it has been mining on the lime-bed of the Utah Consolidated, and sets forth that the Utah Apex's newly discovered ore is but a continuation of the Yampa lime-bed, and as that orebody apexes in Utah Consolidated ground, Utah Apex is liable for having mined there. Several conferences have been held between Utah Apex and Utah Consolidated, but as yet no definite step has been taken to bring the matter before the Court. Another large deposit of ore was developed last year by Utah Metal & Tunnel Co. in a lime-bed which is in dispute between the Utah Consolidated and itself. This is the orebody that is spoken of in the annual report of the latter company as one of the title of which is "expected to be settled amicably." The discovery of the large body of ore in dispute between these two companies was made last fall when the Utah Metal, after following down a lime-bed in its property for over 1400 ft., came upon a large orebody and discovered that its neighbor, the Utah Consolidated, was raising from below in the same bed. The workings of the two companies here came together and the respective managers have arranged to have the underground conditions examined by engineers whose reports are to be submitted by agreement to the officials of the companies.

Utah Consolidated pays 50c. per share on July 17. This makes $1 for 1918.

CANADA

British Columbia

The five leading mining companies of British Columbia have declared dividends for the first half of the year 1918 as follows:

Granby Consolidated Mining & Smelting Co	$749,924
Consolidated Mining & Smelting Co	523,872
Howe South Co. (Britannia mine)	198,415
Hedley Gold Mining Co	96,000
Crow's Nest Pass Coal Co	62,126
Total	$1,610,337

The Howe Sound Co. leads in the ratio of dividend to capitalization, its rate being 5% per quarter or 20% per annum. Granby leads as the largest dividend payer in the Province, its total to date aggregating $10,198,895. Both Granby and the Consolidated M. & S. Co. pay dividends at the rate of 10% per annum.

MEXICO

Chihuahua

Juarèz.—Epifanio Holguin, the Villa leader who has been robbing trains and looting ranches in northern Chihuahua, has ordered the Erupcion Mining Co., an American company operating mines 85 miles south of here, to stop all operations, according to the owners of the mine, who reached Juarez recently. Freight wagons, lumber, and other materials at the mine have been burned, and the workmen warned not to approach the property. The reason given for the order was the refusal of the company to pay Holguin a ransom. Miguel Holguin, brother of the Villa leader, has accepted amnesty and has joined the Federal

forces at Chihuahua City, having appeared at Villa Ahumada and surrendered.

Hidalgo

Pachuca.—The U. S. S. R. & M. Co., operating the Real del Monte mines and mills, reports for the first half of 1918 that an average of 56,500 tons of ore has been treated monthly, an increase of 1900 tons compared with the second period of 1917. Silver realized 93c. per oz. for the current year.

Jalisco

Etzatlan.—The Amparo Mining Co. has issued its report for 1917. During the first half, capacity was at 50%. For the first seven months there was a shortage of cyanide. Supplies advanced in price from 50 to 300%. Considerable development was done, and repairs made. Flotation was tried, but, although encouraging, cyanidation will be continued. The year's receipts totaled $1,220,964, including $1,052,239 from bullion and concentrate, and $138,302 profit on silver certificates sold. The operating profit was $195,565, less Philadelphia expenses and taxes, leaving $178,065 net. Dividends amounted to $320,000. The surplus of $1,581,139 at the beginning of the year was reduced to $1,269,037 at the end. Current assets total $1,293,455, and liabilities $517,850.

The general manager, J. H. Howard, states that although bandits took the town of Etzatlan, operations were little disturbed from this source. Military protection and watchmen cost $38,199. Development amounted to 1616 metres in ore and 1110 metres not in ore. A large stope was opened at 1000 ft. depth, but little has been exposed at 1300 ft. Reserves, according to the engineer, W. R. Askew, total 481,572 tons, of which 341,622 tons is positive.

The mill worked 67.7% of possible time, treating 84,277 metric tons of ore, a decrease of 14,763 tons compared with 1916. The average assay was 7.93 grammes gold and 326 grammes silver per ton, an increase of 8 of silver, but a decrease of 2 of gold. The theoretical extraction was 87.84%, a drop of 3.26%. Costs are given in considerable detail; they were as follows: mining, $2.58; development, 85c.; crushing and tramway, 25c; treatment, $3.73; selling expenses, 67c.; general charges, $1.23; taxes, $1.15; premium, 12c.; miscellaneous, 9c.; a total of $10.79 per ton.

Total bullion extracted was 24,250 kilogrammes of silver and 608 kilogrammes of gold, equal to 776,000 oz. and 19,456 oz., respectively.

Mexico

El Oro.—The Esperanza Mining Co. has issued its report for 1917. Bullion and concentrate production, etc., was valued at ₱1,822,895. Mine operations and taxes cost ₱1,435,436. The profit was ₱121,965. Dividends amounted to ₱112,500. Current assets total ₱1,074,458, and liabilities ₱61,359. The political conditions in Mexico were satisfactory, but the economic conditions did not improve. The mill treated 181,935 metric tons of ore, filling, and dumps, a gain of 68,014 tons. Development totaled 9908 ft. Diamond-drilling at El Sirio was not encouraging. A re-estimate of ore-reserves showed 65,368 tons, with a recoverable value of ₱1,400,000, and profit of ₱400,000. This does not include old filling. At present the tailing dump is not profitable to treat.

Sonora

Nacozari.—The Progreso Silver Co. is constructing a 100-ton all-sliming cyanide mill to treat ore from the Progreso-Colorada silver-gold mine on the east side of the Moctezuma river, 100 miles south of Nacozari. This mine has shipped $1,000,000 of high-grade silver ore at different times since 1898 to the Douglas and El Paso smelters. Dumps and reserves in the mine total 40,000 tons, available for the new mill. Five parallel veins are worked. The ore is highly silicious, carrying 25 oz. of silver and 0.2 oz. gold per ton.

PERSONAL

Note: The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

Paul Couldrey is in active service in France.

Kirby Thomas has returned to New York from Arizona.

F. C. Brown has returned to Boise, Idaho, from a trip to Nevada.

W. B. McPhee, recently at Como, Nevada, is now in San Francisco.

Ben. B. Lawrence is returning to New York from Cornucopia, Oregon.

F. D. Adams, professor of geology in McGill University, has gone to London.

William W. Mein was in San Francisco this week-end, on his way to Los Angeles.

E. B. Thornhill, of the General Engineering Co., has moved from Ottawa to New York.

William Loeb Jr., C. K. Lipman, and **F. R. Foraker**, of the A. S. & R. Co., were here this week.

Ernest J. Stanley has been appointed chief engineer for the El Tigre Mining Co., Sonora, Mexico.

F. W. McNear, president of the Michigan College of Mines, is doing Government work at Washington.

A. D. Cox has gone to Dome, Yuma county, Arizona, to take charge of an old lead-silver mine for the Reorganized United Mines Company.

Rensselaer H. Toll is investigating chrome production in Fresno and neighboring counties under **Albert Burch**, for the U. S. Bureau of Mines.

M. M. Summerhayes, formerly manager for the Porcupine Crown Mines, is now manager for the Bluestone Mining & Smelting Co. at Mason, Nevada.

P. R. Bradley, of the Alaska Juneau and Treadwell mines, has been appointed Food Administrator of Alaska to succeed the late Judge **R. A. Gunnison.**

O. McCraney, mine superintendent for the White Caps Co., Manhattan, Nevada, has accepted a similar position at the Eagle Shawmut mine, California. **W. L. Taylor** succeeds Mr. McCraney.

M. J. Murphy succeeds **W. L. Cole** as superintendent for the Mountain Copper Co., Kennett, California. Mr. Cole retires on September 1 after 23 years service. **E. L. Stenger** has been appointed assistant superintendent.

H. R. Robbins has severed his connection with the Granby Consolidated M. S. & P. Co., Ltd., for the duration of the War, and has been commissioned Captain, National Army, assigned to special duty with the General Staff.

Obituary

William Johns, foreman of the Camp Bird, died at Ouray, Colorado, on July 2.

Angus Mackay, manager of the Vulture mine, in Yavapai county, Arizona, died suddenly at Oakland on June 29. He was the son of the late Senator Mackay of Montreal and graduated at McGill University.

The Mining Society of Nova Scotia held its 26th annual meeting at Sydney on May 1 and 2. There were sixty present, the retiring president, **D. H. McDougall**, being in the chair. The new officers are: **Thomas Cantley**, president; **A. J. Tange** and **G. D. McDougall**, vice-presidents; and **E. C. Hanrahan**, secretary-treasurer. Four interesting papers were read, generally dealing with coal-mining problems.

THE METAL MARKET

METAL PRICES

San Francisco, July 9

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound.	15
Copper, electrolytic, cents per pound, in carload lots.	26.00
Copper, electrolytic, cents per pound, in small quantities.	27.30
Lead, pig, cents per pound.	8.30— 9.30
Platinum, Government price, per ounce.	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound.	11
Zinc-dust, cents per pound.	17½

ORE PRICES

July 9

Antimony, 45% metal, f.o.b. California, per unit.	$1.10
Chrome, 38 to 48%, California, per unit.	$1.25—$1.50
Magnesite, crude, California, per ton (nominal price).	$7.00—$8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29).	$0.86—$1.30
Manganese, domestic, 35 to 54%, f.o.b. east of South Chicago, per unit (Government price, effective May 29).	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2.	$1.25
Pyrite, per unit of sulphur, cents.	28
Tungsten, 60% WO_3, California, per unit.	$24

Tungsten prices, as quoted by this and other mining journals, have been declared as being too high; but we learn that large sales have been made at $25 per unit, disproving such assertions.

EASTERN METAL MARKET

(By wire from New York)

July 9.—Government price for copper advanced to 26c. on July 2. Lead is quiet, though strong. Spelter is easier, but firm.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange.

Date	New York, cents	London, pence
July 3	99.62	48.81
" 4 Holiday		48.81
" 5	99.62	48.81
" 6	99.62	48.81
" 7 Sunday		
" 8	99.62	48.81
" 9	99.62	48.81

Average week ending	
May 28	99.50
June 4	99.50
" 11	99.50
" 18	99.50
" 25	99.50
July 2	99.50
" 9	99.62

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	....
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	....
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	....
Apr.	64.37	72.51	95.36	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Advice from Samuel Montagu & Co. of London, dated June 13, says that the tone of the silver market continues good, especially now that Shanghai exchange has risen to a point closely approximating that at which silver purchases for China might become profitable. The scarcity of silver in Europe is suggested by a report that current silver coin is being melted down in Holland in order to provide material for industrial purposes. In normal times such an operation could not have been profitable in Holland, unless the local quotation for silver had exceeded the parity of 60¼d. per oz. There is a reduction of 91 lacs ($2,730,000) in the silver holding of the Indian Treasury, but the amount of silver on the way from the United States is considerably less, and the total within India has increased by a couple of crores ($32,000,000). The stock in Shanghai on June 1 consisted of 29,500,000 oz. in bars and 15,300,000 Mexican dollars, compared with 31,300,000 oz. and 15,900,000 dollars on May 25.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 7.90c. per lb., New York.

Date	
July 3	7.90
" 4 Holiday	
" 5	7.90
" 6	8.05
" 7 Sunday	
" 8	8.05
" 9	8.05

Average week ending	
May 28	7.07
June 4	7.16
" 11	7.31
" 18	7.61
" 25	7.82
July 2	7.90
" 9	7.99

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	....
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	....
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.30c., respectively, until August 15. Quotations in cents per pound are as under:

Date	
July 3	26.00
" 4 Holiday	
" 5	26.00
" 6	26.00
" 7 Sunday	
" 8	26.00
" 9	26.00

Average week ending	
May 28	23.50
June 4	23.50
" 11	23.50
" 18	23.50
" 25	23.50
July 2	23.50
" 9	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	....
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	....
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

Additional to the above heading on the increased price for copper, the small or high-cost producers are to be considered by the War Industries Board on August 6.

Secondary copper produced in the United States in 1917 totaled 383,400 short tons, all from scrap.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
July 3	8.85
" 4 Holiday	
" 5	8.85
" 6	8.85
" 7 Sunday	
" 8	8.85
" 9	8.85

Average week ending	
May 28	7.50
June 4	7.50
" 11	7.56
" 18	7.70
" 25	8.18
July 2	8.78
" 9	8.85

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	....
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	....
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds:

Date	
June 11	110.00
" 18	110.00

June 25	110.00
July 2	120.00
" 9	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	....
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	....
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	...
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	....
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ORES (New York)

Antimony: No transactions or developments are heard of in this market.

Ferro-manganese: Imports in May are officially reported as 4138 tons, with the prospects that the June figures will show at least 5000 tons. Electrolytic 80% ferro from Japan has appeared in this market.

Manganese: The market seems to be easier. Offerings of Indian high-grade ore have brought bids of $1.38 per unit, compared with a former recent price of $1.45. Brazilian ore is also said to be available at $1.05 per unit, seaboard, but this is hardly credited.

Molybdenum: A report is to the effect that a small lot has been sold at $1.25 per pound.

Tungsten: A fair business for the last week is reported done at the unchanged prices of $20 to $24 per unit. Ferro-tungsten seems strong at $2.40 per pound of contained tungsten.

Eastern Metal Market

New York, July 3.

The markets are all strong but none are particularly active. Price changes have been of little consequence except in zinc.

A change in the copper price has been made, a result of yesterday's unexpected meeting in Washington, the price being advanced to 26c. per pound.

Tin is extremely quiet with practically no business because of lack of offerings.

Lead is quiet but strong at agreed maximum prices.

Zinc is moderately active, but strong and higher.

Antimony is quiet and unchanged.

In the steel trade striking news is not abundant. An important item is the fact that the steel manufacturers' committee is in conference in Washington this week with a view to fixing prices on rails, wire-rope, and steel and malleable castings. The question of some re-adjustment in pig-iron is also to be discussed. Lake Superior ore producers have decided that the 45c. advance in price noted last week shall apply only in part to 1918 contracts, that is, to ore unloaded at Lake Erie docks after midnight on June 30.

June pig-iron returns by wire to 'The Iron Age', with several furnaces estimated, show a slight falling off as compared with May, the total being 3,323,791 gross tons for 30 days or 110,793 tons per day against 111,175 tons per day in May.

COPPER

An entirely unexpected meeting was held in Washington on Tuesday afternoon, July 2, between the representatives of copper producers and the War Industries Board. The former were summoned to Washington by telegraph. It is understood that this is the August 7 meeting, previously arranged for late in June, advanced to the present time. When in June the price question was settled by a continuation of the present 23.50c. price to August 15, there was much dissatisfaction, and another meeting was later called for August 7. It was believed that there was something in the wind as to a new price and that an advance was to be authorized, to be retroactive to July 1, but no higher price than 25c. was expected, although the conditions justify several cents above that figure. One reason offered for the rise is the increase in freight rates. Believing that a change in price was likely, producers were booking orders only on the condition that they be subject to any new price. It is a fact that there has been no acquiescence by producers in the continuance of the old 23.50c. price after June 1. The announcement of an increase in price to 26c. has shown a disposition to accept the opinions of producers, and this is encouraging. The demand is now larger and it is stated that producers are very much behind in their May deliveries. An interesting rumor is to the effect that a proposition has been made to the Government that it temporarily take over the operations of all small producers having a high cost of output, and who produce 75,000,000 to 100,000,000 lb. per year. Another proposition is that the Government take the output instead of the control and allow a reasonable profit to the small producer. The May output of blister copper is estimated to have been 170,000,000 to 175,000,000 lb. or 10,000,000 to 15,000,000 lb. under estimates.

TIN

Due to a decided lack of offerings the market has been dull and slow again. There has been a dearth of offerings of all kinds, which has for the time put a decided check on transactions. Considerably more interest has been manifested by buyers, but they could not obtain what they have wanted during the last week. According to a large importer there have been no offerings of Straits tin in the week covered by this report. The licenses to ship English Lamb and Flag tin have been temporarily held up. Confirmation of this statement has been unobtainable in this market but one large dealer believes there is something in it because of the dearth of offerings cited above. The price-fixing matter is still in the air, but nothing definite is heard about it. It may come to something and it may not. It is certain that a fixed price is obtainable only by agreement between the American and British governments. Deliveries of tin in June were larger, totaling 6782 tons, of which 998 tons came in at Atlantic ports, and 5784 tons at Pacific ports. Stock and landing on June 30 was 95 tons. The June deliveries compared with a little over 5000 tons in March and April, and 4056 tons in May. The London market is a little higher than a week ago or £332 10s. per ton for spot Straits as compared with £332 per ton a week ago.

LEAD

A concerted and determined effort on the part of lead producers to prevent the market reaching premium prices has resulted in a mutual agreement to fix the price at 7.75c. per lb., St. Louis, or 7.90c., New York. The American Smelting & Refining Co. took this position early last week and it has become general. The object is clear—to avoid a maximum price by the Government. Not very much is being offered, but such as appears is generally going at 7.90c., New York. There is evidently a scarcity, at least supplies are no more than equal to the demand. The re-adjustment of the New York price to 7.90c., as compared with 7.82½c. a week ago, is due to the advance in freight rates. There may be further changes from this same cause.

ZINC

The market has continued to advance during the last week until yesterday prime Western had sold and was quoted at 8.65c., St. Louis, or 8.85c. per lb., New York, for July or early delivery. As high as 8.62½c., St. Louis, or 8.87½c., New York, was noted, with a premium of at least ⅛c. per lb. asked for August-September delivery. One cause of a stronger market has been large buying in the last 10 days of prime Western and grade C by the Government. This is estimated to have amounted in all to at least 10,000 tons. The Navy Department has also bought 1000 tons of grade B and 500 tons of grade C which are reported to have gone at 9.75 and 8.36c. per lb. respectively. The sale price of the prime Western, 9000 tons of which went to the Ordnance Department of the Army, is not publicly known. At present the demand has died down, though a sale of 1000 tons of prime Western is noted as of yesterday. It is believed that the crest of the upward movement has been reached for the present, and that an easier market is likely for a time at least, due to the fact that some producers who did not sell to the Government are probably ready now to sell to others. In fact, one quotation yesterday appeared for 8.50c., St. Louis, or 8.70c., New York, for July delivery. There has been some inquiry from galvanizers.

Sheet zinc is officially fixed at 15c. per lb. base, with plate zinc at 14c. per lb. Grade A zinc has also a maximum price of 12c. per pound.

ANTIMONY

The market is quiet and dull at 13 to 13.25c., duty paid, New York, for prompt and early delivery of Chinese and Japanese grades.

Book Reviews

Powdered Coal as a Fuel. By C. F. Herington. Pp. XI-211, 84 ill., index. D. Van Nostrand Co., New York, 1918. For sale by 'Mining and Scientific Press.' Price, $3.

The use of pulverized coal is expanding with great rapidity. The efficiency obtainable, as compared with coal burned in the ordinary way, is so great that it offers the fuel engineer an opportunity to still further decrease the cost of generating steam, and the smelter an opportunity to largely augment the capacity of his furnaces. When it is realized that steam engineering has advanced to such a point that two years ago, at the costs then prevailing, it was possible to ship bituminous coal as much as 200 to 300 miles from the mines to the Atlantic coast and to burn the run-of-mine under boilers with the aid of automatic stokers, and convert the power developed into electric energy at a cost of about 0.4c. per kilowatt hour at the switchboard, it will be seen that the added efficiency of burning the coal in the pulverized form will long sustain the steam-plant as a competitor with hydro-electric installations. Although powdered coal was employed for burning cement clinker as much as 40 years or more ago, it is probably not an over-statement to say that the development of the art is still in its infancy. This finds substantiation in the fact that the engineers who have written upon it seem to have no exact idea of the character of the new physical conditions that are created when the coal is reduced to a fine state of subdivision, although they recognize that some marvelous change has taken place. Until the nature of a substance is completely comprehended the most intelligent adaptation of it to industrial use is not possible. It is true that the combustibility of coal, that is, its rate of combustion, increases in proportion as the superficial area is extended by fine-grinding. The smaller the particle the greater its specific surface, as every mathematician knows. If this be continued until the smallest particle that can be produced mechanically has been reached, this minimum dimension yields what is called a colloid. It consists of an aggregation of only a few molecules, and in that state the original nature of the material in some notable respects has become fundamentally changed. Suspended freely in a medium the particles will be found to possess erratic movements of their own, quite unrelated to the effect of gravity. Moreover, such particles condense upon themselves large quantities of certain gases. This is the phenomenon of adsorption, and in the case of coal or other carbonaceous colloids the oxygen is preferentially adsorbed, until the gas, to the extent of many times the volume of the particle, is thus condensed upon it. Under these circumstances it will appear why the velocity of chemical combination between the carbon of the colloid and the associated oxygen takes place at such a high velocity. Herein also lies the explanation of the fact that carbonaceous colloids, under some conditions, develop explosive energy. This occurs, apparently, when the amount of air holding it in suspension is such that practically the total quantity of oxygen contained therein becomes adsorbed. Beyond this volume no more oxygen can be condensed, but, the dilution of the mixture being greater, the separation of the particles is wider, so that the velocity of the combustion is retarded; to state it otherwise a detonating wave then cannot develop because it cannot be transmitted on account of the gap between the particles. In crushing coal, as practised today, only a fraction of it becomes subdivided to colloidal dimensions, and it is evident that enormous possibilities exist for improvement in such details as the methods of preparation, determination of the conditions favoring maximum adsorption of oxygen, the admixture with air for feeding into the combustion chamber, and similar problems. The volume written by Mr. Herington treats these theoretic features lightly. For information of that kind the reader must resort to periodical literature, for it has not yet become crystallized in book form, and much remains to be investigated in our research laboratories. The thing, however, that Mr. Herington has done, which is an important achievement, is to discuss correctly and fully the present state of the art. On this account, and because he gives the detail so abundantly, the work is of great value. He tells what coals yield the best results under the existing systems of handling it, how the coal is crushed, the efficiency of a large number of different machines, costs of preparation, influence of moisture on the thermal efficiency, how to dry the coal economically, and the practical means adopted for successful feeding in cement kilns, boiler fire-boxes, and reverberatory furnaces. His summary of the earlier use of pulverized coal in copper metallurgy at the plants of the Canadian Copper Co., and at the Washoe Reduction Works, at Anaconda, will be of special interest to mining engineers. The book was issued before the brilliant success recently achieved at the smelter of the Nevada Consolidated Copper Co., at Ely, Nevada. The growth of this practice of firing with pulverized coal in reverberatory copper-smelting bids fair to drive oil out of use for that purpose. The data collected in this volume will be of great value to engineers who wish to keep abreast of the times. It gives the practical facts necessary as a preliminary to a more exhaustive study of the subject. C. DeK.

Coal Catechism. W. Jasper Nicolls. Pp. 249, index. J. B. Lippincott Co., Philadelphia, 1918. For sale by 'Mining and Scientific Press.' Price, $1.50.

This handy little book is a reprint from an edition published originally in 1915, and is in fact a development from a catechism that has been before the public since 1898. Such continued demand shows that it fills a want. Mr. Nicolls is a member of the American Society of Civil Engineers, and is a thoroughly competent authority; in addition he possesses the unusual merit of being able to explain that which is essential as an answer to pertinent questions that could be propounded by any bright person. This is the peculiar quality of mind required for presenting knowledge in the form of a catechism. As a short and easy course to a considerable volume of information regarding the occurrence of coal, the mining of coal, and problems of distribution, together with the elementary theory of heat, and of power-development, the book is to be commended. The chapters on metallurgic uses, gasification, and coke are quite satisfactory, but we regret that he has not added a chapter on pulverized coal and an extension to his chapter on by-products in coking, considering the recent interest in those subjects. The book will continue to be useful.

The Elements of Coal Mining. By Daniel Burns, London. Pp. 236, ill., index. Longmans, Green & Co., New York, 1917. For sale by 'Mining and Scientific Press.' Price, $1.10.

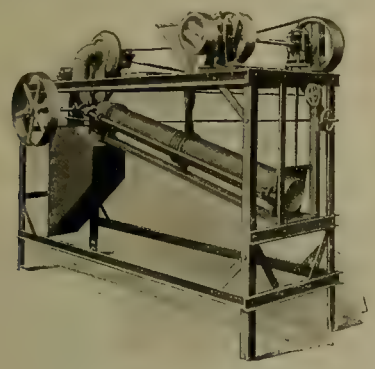
In the writing of elementary treatises upon technical subjects the English practitioners possess a peculiar knack, which generally gives a high practical value to their productions. This praise may be justly bestowed upon the neatly printed and well illustrated book before us. It is distinctly elementary, but it deals with the problems that arise in everyday operations, and tells how to overcome the difficulties that are encountered. It is a book that will be appreciated by those having to deal with coal, and it also will be found suggestive in many details regarding mining methods applicable to metalliferous deposits; this applies particularly to methods of laying out coal-veins for exploitation, of supporting roofs and sides, and of ventilation. The chapters dealing with handling water and with winding appliances are most useful.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

THE MEYER DRY CONCENTRATOR

The Meyer dry concentrator marks a new development in the practice of dry concentration, and is the result of several years' experimental work. The concentrator is operated upon the principle of the exhaust instead of pressure. It is claimed that this produces a more delicate adjustment with a resultant increase in the selective action, making a much cleaner separation than heretofore has been possible. Test runs have been made on practically every kind of concentrating ore, comprising sulphides, carbonates, and many of the oxides, while lead, zinc, copper, molybdenum, tungsten, pyritic and complex sulphide ores have been given special attention. It is claimed that extractions of 90% of the metallic content of these ores have been made with a remarkably clean product. Various models are being manufactured. Model B, shown in the accompanying illustration, represents one unit of the concentrator, the mechanical construction being a radical departure from established methods. This concentrator is equipped with an exhaust fan of variable suction capacity, and by means of a blast gate-valve each fan can be regulated so that practically any desired suction can be obtained. The smallest concentrator consists of three units, generally termed 'cylinders', being equipped with one each of the three sizes of exhaust-fan used. The standard sizes have eight and ten cylinders, the cylinders all being of the same size, while the exhaust-fans may be of various sizes or all of one size, depending upon the fineness of the ore to be treated. The standard sizes of concentrators have a capacity of about 25 to 30 tons of ore per day. It is claimed that all of the various sizes of crushed ore from the largest down to dust can be treated with success.



THE MEYER DRY CONCENTRATOR

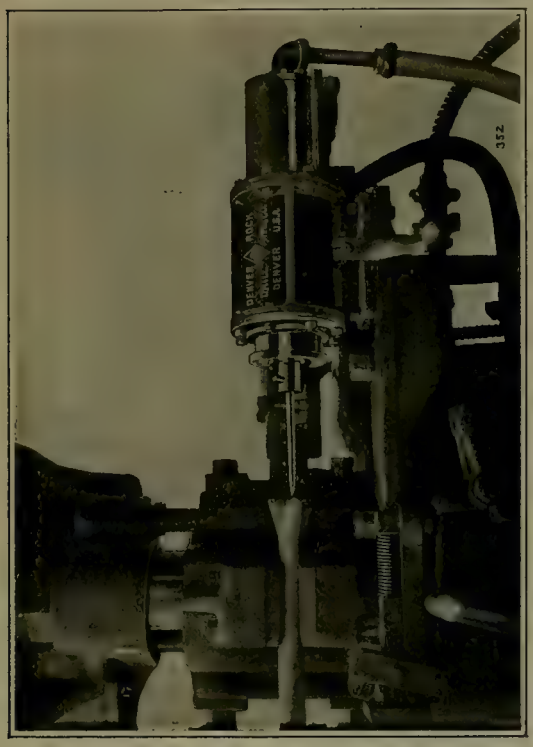
The ore is crushed dry, and a specially designed 'unit' or cylinder of this concentrator receives the crushed ore, the exhaust-fan drawing off all the dust made in the process of crushing. The entire apparatus is enclosed so that no dust can escape into the atmosphere of the concentrating-room. Whatever dust may remain in the ore is eliminated through the exhaust-fan as the tailing is being withdrawn, and is delivered wherever desired. The dust and such finer sizes as it may be desired to eliminate can be stored and treated, if sufficiently valuable, by flotation, cyanidation, or amalgamation. The concentrator is patented. It consists of inclined revolving cylinders into which the ore is fed by gravity through a hopper at the middle point. The cylinders are riffled on the inside, causing the ore to be elevated and tumbled into the middle of the air-current as the cylinders revolve, and the suction of the fan draws the gangue farther up the cylinders with each revolution, while the concentrate, being too heavy for the suction, falls toward the lower or concentrate-end of the machine. The exhaust fan connects with the cylinders through an air-tight compartment, termed a settling-box, which discharges the tailing from the air-current before the fan is reached, the tailing being removed in a steady flow through a small adjustable door in the lower end of the settling-box. Model A of this concentrate is equipped with a light agitating-brush, which revolves within the cylinders, causing a thorough dissemination of the ore. It has been found that in two years the wear on the brush has been negligible. The concentrator is controlled from the concentrate end, the same as in the other models, and several turns of the adjusting-wheel, manipulating the blast gate-valve, close or open the valve in the blast-gate so that the suction is decreased or increased as desired, permitting a smaller or larger size of ore to be fed into any cylinder, and so changing the feed that each size can be run one after the other. The suction force of any fan can be controlled so as to successfully concentrate any size, the range of 10 different sizes being within the capacity of the fan. In case there should be 20 different sizes to be treated an installation of 20 cylinders is recommended. This permits each size to be permanently connected with its own individual cylinder, and once connected it keeps on continuously concentrating that size. By means of this appliance lead sulphide has been separated repeatedly from zinc sulphide and from copper pyrite, while iron pyrite, also, to a considerable extent, has been separated from both lead and zinc sulphides. Tungsten minerals have also been separated from copper pyrite.

The Meyer dry concentrators are made of metal throughout, the cylinders being of heavy sheet steel, while the frame is substantially built of channel and angle-iron. The National Milling & Refining Co., of Canton, Ohio, is manufacturing and marketing the concentrator. Various sizes are being made to meet the requirements of both the large and small operator. Its catalogue describing the Meyer concentrator and the process of dry concentration has just been issued. The company is ready to submit to thorough investigation by mining engineers of the concentrator and its performance. Mining engineers who have witnessed demonstrations of these concentrators in operation in the testing mill at Canton, Ohio, state that an extremely clean separation is made.

W. H. Callan, general manager of plants, and W. P. Pressinger, general manager of sales, have been elected vice-presidents of the **Chicago Pneumatic Tool Co.**, Chicago.

THE MODEL 10 'WAUGH' DRILL-STEEL PUNCHER

The puncher shown in the illustration is a unique and efficient little pneumatic device that is now being put forth by the Denver Rock Drill Manufacturing Co., Denver, Colorado, as an attachment to its model 8 sharpener. Its purpose is to open the hole in the end of a piece of drill-steel while being worked into a bit, collar, or lug. The punch is held in a tappet-chuck. This chuck and a hammer are set



A DRILL-STEEL PUNCHER

in an air-feed cylinder. When opening up a water-hole the punch is simultaneously hammered and fed forward into the steel. The action of the hammer and air-feed cylinder are controlled by a single handle. The device will open a bit or shank in one-tenth the time required to perform the operation by hand. Where such an arrangement is desirable it may be mounted separately or even adapted to other sharpeners.

The National Tube Co., Pittsburgh, Pennsylvania, calls attention by an illustrated circular to the progress that it has made in 28 years in the production of steel pipe. It is interesting to note that steel pipe was first made in this country in 1887, the first year's output being about 300 tons. Comparing the products of years of normal business only, the output of wrought-iron pipe in 1915 had declined to 262,198 tons, from its position at 500,000 tons in 1888, while steel pipe had grown to 2,037,266 tons. This merely emphasizes the change in metallurgic methods within that period. It was about that time when Alexander Holley made his famous reply to critics of the new steel process that he had been so earnest in developing, that "the open-hearth process will live to attend the funeral of the bessemer process." At that time the advocates of bessemerizing were struggling vainly to produce steels to meet the ordinary requirements of wrought and malleable cast-iron. Defects in the steel, however, limited its application to a few large structural uses and to steel rails, while the open-hearth process was demonstrating wider efficiency, and giving promise of the great future that is now a reality. The manufacture of wrought-iron is costly, because an excessive employment of hand labor is unavoidable in the process. The open-hearth steel furnace, by almost wholly mechanical methods, will turn out an enormous tonnage of metal, with great economy in the application of the fuel, and the product is a dependable steel of almost any grade desired, fulfilling the conditions where either steel or wrought-iron would have been specified in the older practice. The tables and curves of progress in the use of steel for pipe, presented in the circular issued by the National Tube Co., therefore, illustrate the advance in metallurgic methods in this country during the last 30 years.

COMMERCIAL PARAGRAPHS

Sutton, Steele & Steele, Inc., of Dallas, Texas, announce the appointment of L. G. E. Bignell as sales manager of their business.

N. C. Falls and **W. C. Doak**, of Toecane, North Carolina, are planning for the immediate installation of mining machinery for the development of asbestos properties in that district.

The Empire Graphite Co., Ashland, Alabama, is considering plans for the immediate re-construction of its plant recently destroyed by fire, the loss being estimated at about $40,000.

The Magnolia Metal Co., 113 Bank street, New York, has recently completed construction work on a large new smelting plant at Matawan, New Jersey. The works will be used for the treatment of antimony.

Joseph Dixon Crucible Co. reports that extensive use of its silica-graphite paint, made by John Gribble, mechanical engineer of the Niulii plantation, Kohola, Hawaii, has demonstrated an unusual resistance to the severe effects of a tropical climate. This is a far more severe test than paint is subjected to in temperate climates.

The United States Graphite Co., Goodwater, Alabama, recently organized with a capital of $300,000, is planning for the immediate development of about 120 acres of graphite properties, to have an initial output of 100 tons. It is proposed to commence work at once on a flotation plant to cost $100,000. B. L. Daddis is president and T. C. Hadley is vice-president and manager, both of Montgomery, Alabama.

Ingersoll-Rand Co. announces a bulletin on portable mine-car air-compressors, designed to meet conditions in the service, for use where electric power is available. The compressor is driven by a bath-lubricated herring-bone gear, enclosed to keep out dirt. The pamphlet is illustrated, and shows the machine at work underground. The same concern has published a circular describing a compact high-speed steam engine, listed as class 'FP,' made in four sizes, developing from 15 to 90 indicated horse-power.

Contracts have been awarded by the **Butterworth-Judson Corporation**, of New York, for construction work in connection with the erection of the large new plant at Brunswick, Georgia, to be devoted to the production of picric acid for the Government. Necessary structures for two sulphuric-acid concentrators, commissaries, warehouses, etc., will be erected at once by Hugger Bros., Montgomery, Alabama. The site for the proposed plant comprises about 1400 acres on Turtle island, in the Turtle river, near Brunswick. An investment of approximately $5,000,000 will be involved in the construction of the plant and $2,000,000 for townsite development. The works will give employment to about 5000 men.

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$4 per Year

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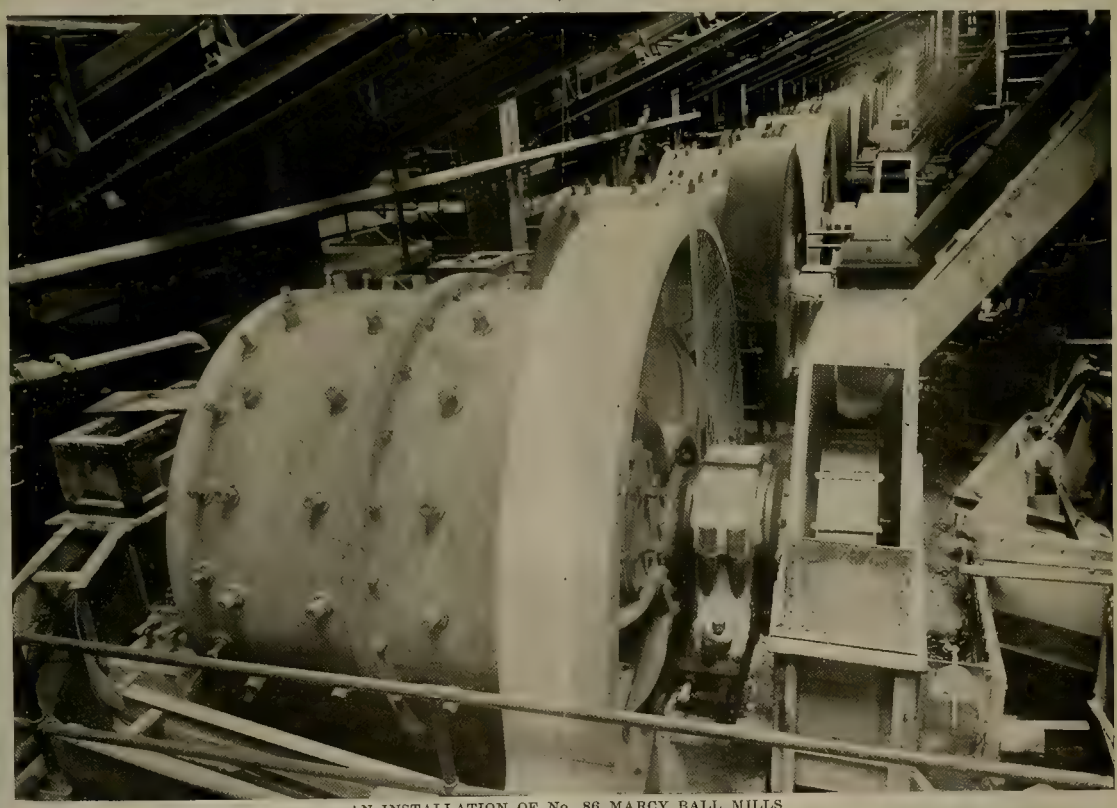

AN INSTALLATION OF No. 86 MARCY BALL MILLS

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EDITORIAL STAFF:
T. A. RICKARD, Editor
COURTENAY DE KALB, Associate Editor
M. W. von BERNEWITZ, Associate Editor

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BUSINESS STAFF:
C. T. HUTCHINSON, Manager
E. H. LESLIE, 600 Fisher Bldg., Chicago
A. S. BREAKEY, 3514 Woolworth Bldg., New York

Science has no enemy save the ignorant

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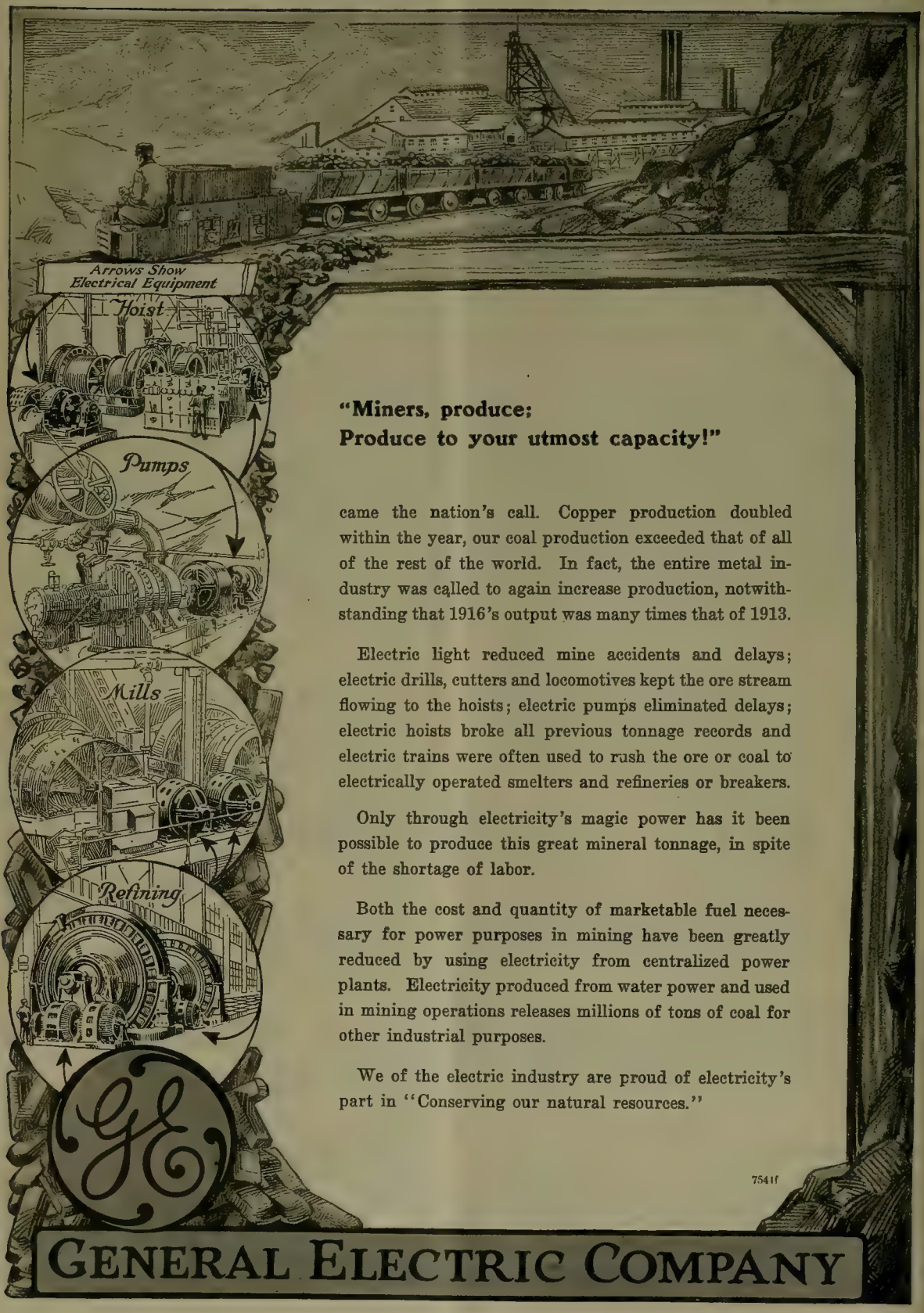

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GENERAL ELECTRIC COMPANY

EDITORIAL

RISES in the prices of metals, namely, copper to 26, lead to 8, and zinc to 8.85 cents per pound, have been followed promptly by an advance in wages at the mines. In Arizona, Montana, and Utah, the copper companies have granted an increase of 50 cents per shift, likewise the silver-lead mining companies of the Coeur d'Alene in Idaho.

YUKONERS and Alaskans, not to mention other mining men nearer the centres of civilization, will have read with pleasure the dispatch from Paris telling how "an American from Nome, Colonel Joseph Boyle" saved Rumanian deputies from exile and was rewarded by a decoration at the hands of the king of Rumania. Joseph W. Boyle is a big-hearted broad-chested Irishman, conspicuous in pre-war days for his dredging operations on the Klondike and prominent during the War for his effective patriotism. We are not surprised that he has distinguished himself, for he is a born leader of men.

'CHROMITE' is the title of a 30-page pamphlet written by Messrs. Albert Burch and S. H. Dolbear, and published gratuitously for them by us for distribution among those seeking or producing this important war-mineral. The pamphlet is now ready; anybody desiring a copy should write to Mr. Burch, at the Crocker building, San Francisco. Incidentally it may be added that the Government has ordered the construction of a road in Siskiyou county, California, to make available 30,000 tons of chrome that Mr. Burch has estimated to be mineable. In the Mining Summary this week we show a plan of the new road and of the region generally.

SALT LAKE CITY has been elected to greatness by natural endowments and no one is disposed to begrudge the distinction, because geographic advantage is a fact that human sentiment cannot alter. It is unbecoming, however, to allow economic superiority, which is a matter of circumstances only, to encourage megalomania. The senator from Utah, Mr. William H. King, did not specifically mention Salt Lake as a permanent abode for the Geological Survey and the Bureau of Mines in bill S.4789, which he introduced in Congress the other day, but the ambition to grasp a goodly portion of the Interior Department from Washington was hardly concealed in the suggested legislation. Mr. King was undoubtedly 'talking for Buncombe', and may his 'Buncombe' give him the honor due. If these great bureaus of the Department of the Interior should be wrenched loose from their proper place at the centre of government and transplanted "west of the Mississippi river", to quote the bill, politicians would demand some rare new plums for party fealty. We suppose Seattle would want the Post Office Department; Reno would soon aspire to the Department of Justice; and Nebraska might specify the fitness of the town of Lincoln as the home for the Department of State. "Resist the beginnings of evil," wrote the author of the 'Imitatio'. The bill was read twice and referred to the Committee on Public Lands. Requiescat in pace!

GOLD as an essential for financial health is discussed at length on another page. As soon as Mr. McAdoo's letter, quoted by Mr. W. J. Loring in this issue, was made public the quotation of Alaska Gold jumped to $4, from its former dead level of $1 per share. This eccentricity of the market is hard to explain, except by manipulation; the idea that the mine increased in value four times by reason merely of a recognition of the fact that gold is essential to the national effort at this time of war is too absurd. The only factor justifying such a rise would be the sudden uncovering in the mine of an orebody containing, say, a million tons of ore averaging $5 per ton.

A KINDLY old lady is said to have remarked to a recruit at Camp Lewis: "Well, my dear boy, are you prepared to lay down your life for your country?" "No, ma'am," he replied, "but I am preparing to make a German lay down his life for *his* country." No mock heroics for him! He understood the art of war, which is to kill your enemy. The report of a German intelligence officer, recently captured, says that the individual American soldier is "very good." One of them had said: "We kill or get killed." This intelligence officer found the American prisoners "alert and pleasing," but shockingly ignorant of military affairs; "for example, most of them have never seen a map, they are unable to describe the villages and roads through which they marched, their ideas on the organization of new units is entirely confused," and so forth. Like most Germans, this intelligence officer imputed to others a stupidity that was all his own. Simply, our boys would

not give away valuable information, and so pretended ignorance concerning vital matters, of course. Meanwhile General Von Ardeene, a high German military critic, tries to lay the American bogy: "What is a million of Americans compared to the ten million well trained and equipped Russians who have fallen out of the battle-line?" He is discovering the difference already. We seem to have heard that the Russians were not "well equipped" except with German pacifist tracts, and "ten millions" seems too flattering to the Enemy. This military critic continues: "We would not be afraid of five million Americans. They do not know what they are fighting for." Yet even the unintelligent officer of the intelligence department confesses in his report that "a certain moral background is not lacking; the majority of the prisoners simply take it as a matter of course that they have come to Europe to defend their country. Only a few of the troops are of pure American origin; the majority is of German, Dutch, and Italian parentage, but these semi-Americans, almost all of whom were born in America, and never have been in Europe, fully feel themselves to be true-born sons of their country." Indeed they do. We venture to add this: The Germans are going to find the American soldiers most unpleasant, they will find them playing the game of war in no amateur spirit, but with a professional intensity that knows only one end, and that is the killing of Germans. It may not be as romantic as it ought to be, but it is the one sure way to end this War and bring the Germans to a realization of the fact that they proved themselves the biggest fools in human history when they thought they could place their military heel on the free peoples of the earth.

Mining on the Rand

In this issue we publish an authoritative and interesting article on the great South African goldfield by Mr. Hugh F. Marriott, during recent years consulting engineer to Wernher, Beit & Company and to the corporations controlled by that famous firm of financiers and promoters. The article was delivered as a presidential address before the Institution of Mining and Metallurgy, in London, so that it has several claims upon the attention of the profession in the United States. Mining, as Mr. Marriott says, is a subject less easy to discuss than metallurgy, because the older art depends so much upon local conditions, but this need for adaptability gives it a peculiar technical interest. Mr. Marriott reviews the progressive improvement in mining practice on the Witwatersrand from the inside and gives outsiders an excellent idea of the adaptation of method to the gradual expansion of local operations until they became among the most impressive in the industrial world. The engineers of the Rand have been proud, to the point of self-sufficiency, of their accomplishment, and not without reason, but today, of course, our big copper mines are worked on a much larger scale and present a much wider range of technical procedure, due in part to the greater complexity of the metallurgy required to recover the copper as compared with that which suffices to extract the gold. The value of diamond-drilling, for exploratory purposes, is made clear in Mr. Marriott's résumé of early days on the Rand. He himself did a good deal of this work skilfully and we do not wonder that he dwells upon it. Next came the sinking of deep shafts, and the equipment of them with special hoisting-engines, a department of technique in which American engineers, notably Messrs. Hennen Jennings, Hans C. Behr, A. M. Robeson, and R. M. Catlin, took a prominent part. The increasing depth of the mines, and the inevitable tendency toward subsidence as the stopes became extended under the overhanging wall of the lode, rendered the incline dangerous as a main entry and caused the engineers to plan vertical shafts of large capacity. In doing this work resort was had to colliery practice, leading to the engagement of several colliery engineers, notably Mr. H. Stuart Martin, and under their auspices the circular shaft and multiple-stage hoisting were introduced. At this time also the importance not only of ordinary ventilation, but of ensuring a lavish supply of fresh invigorating air to the workers, was realized in practice. Then came the dust problem, intensified by an epidemic of phthisis, threatening the vitality of the miners, and that of their white overseers. The use of water in sprays and through the drills, together with the aid of respirators, has done much to mitigate this evil, which at one time threatened to decimate the drillers and trammers. Notable improvements have been made in pumping and haulage, as Mr. Marriott indicates succinctly. He refers to the inclusion in the ore-reserves of rock too poor to yield a profit and emphasizes the fact that the prime object of mining is to exploit mineral at a profit. In this department of mining economics he has exercised a healthy influence; he has used it against the inclusion, as ore, of 'banket' that under no reasonable expectation could be mined at a profit; he has recognized the fact that the only real 'profit' is one that is divisible among the shareholders—or, at least, among the controlling houses. The statistics of the Chamber of Mines will remain ludicrous for all time on account of their utterly misleading figures of 'cost' and 'profit', as Mr. Marriott knows, for he has tried hard, and successfully, to introduce a more scientific system of accounting into the reports of the important companies with which he is connected. On this subject he is entitled to be heard with respect. We have published his lengthy address in full for this reason, for its general interest, and also because we have recently criticized him frankly for his pathetic attempt to substantiate the fallacy that the mines of the Rand do not show signs of impoverishment in depth. In the early stage of development much timidity was felt concerning the continuity of the ore in depth; such timidity gave place later to the confidence that justified deep mining on a large scale and eventually stimulated an unreasonable expectation of indefinite persistence. This childish belief still obtains. It is curious that, well-

informed and widely experienced as were the leaders of the profession in South Africa, they did not profit by the evidence afforded by the Calumet & Hecla conglomerate, which is a 'banket,' likewise rich in metal, and constituting a lode extensive both in strike and dip, but not without definite limits to its enrichment in both directions. Even to this day it is assumed at Johannesburg that the so-called reefs of the Rand are unique. In some respects they are, as Alexander and Napoleon were unique, but just as surely as Alexander and Napoleon were human, and died, so surely any deposit of ore, however remarkable, must fail in depth. Men think all men mortal but themselves, mine-owners believe that eventually all mines must 'peter out' except their own. Shareholders are encouraged to anticipate an indefinite persistence of ore, and their ignorant optimism is only too often encouraged by engineers that know, or ought to know, better. Mr. Marriott returns to the charge. Of course, nobody takes the yield 'per ton milled' as the basis for an argument on impoverishment in depth, knowing that the decrease of cost incidental to expansive operations and improved technique tends to lower the grade of ore that becomes profitable. On the other hand, the selection of a specified grade, say, 35s. per ton, as the arbitrary limit to 'rich' ore, ignoring the large tonnage of much richer ore won in the upper workings, is equally illogical. In his address Mr. Marriott refers to the compilation that he had the pleasure of exhibiting to the members of the Institution in 1914, and on this later, more auspicious, occasion he appears to have exhibited a similar, but more complete, compilation of the same kind as "concrete evidence of the various gradations of gold deposition." The compilation was a longitudinal section of the Central Rand on which the exhausted stopes were marked in blue, the 'rich' ground in red, the poorer, but profitable, ground in orange, and the unprofitable ground in yellow. We are not sure of the colors, but the scheme was about as stated. This exhibit might have been evidence if his 'rich' ground had not been delimited on a basis much below the current yield, say, of the Robinson and Robinson Deep mines, and, of course, still further below the yield of these and other mines in their earlier years of production, before they became 'deep'. Such evidence is non-scientific; it is not the kind to submit to a technical society. Turning to the evidence on which he appears now to rely, namely, the record of the Village Deep mine and of its neighbors, we venture to say that while the Village Deep has the deepest workings on the Rand, it is a fact that the neighboring deep shafts of the Jupiter, Cinderella, and Simmer Deep, expose ore so poor that they have been abandoned. The tabulation of yields, given on page 83 of this issue, is interesting, but it proves more than Mr. Marriott intended. It will be noted that he gives the average yield of equal blocks of ground along the strike for 40,000 feet, covering the Central Rand. At about the centre are the Village Main Reef and Village Deep, making a fine showing of persistence, at least of ore of average grade, namely, 30 to 35s. per ton. On the edges, however, the blocks average at one end, 24, 21, 28.3, 20, 19.33, and at the other end, 31.10, 20.65, 24.77, 29.33, 27 shillings per ton. The table, in effect, is the graph of an ore-shoot, in the centre of which is the Village Deep shaft. He omits the first 1500 feet. Why so much? Oxidation ceases locally at 300 feet below the surface. The truth about the Rand is better exemplified by the second of the group of blocks as given in his tabulation, namely, from E to I, covering the Robinson mines, the yield of which for the five horizons of 1500 feet each is 66.74, 45.12, 40.19, 32.12, and 27.41s. per ton. In short, Mr. Marriott cites an exception to prove a rule. He knows better. When orebodies become impoverished in depth they do not decline in grade uniformly; bunches of rich ore may persist long after other parts of a lode have ceased to be profitable; impoverishment is marked by a restriction of the orebody or a shrinkage in the length of stoping ground. What are his compilations and tabulations worth in face of the fact that out of the £7,095,066 in dividends paid by the mines of the Rand in 1916 (we have not received the details for 1917), only £2,233,810 came from the mines of the Central Rand, as against £3,650,220 out of a total of £8,887,185 in 1910. During the interval of six years the new and relatively shallow mines of the Far East Rand have helped to redress the impoverishment of the older mining area to such an extent that in 1916 they contributed £2,471,083 in dividends, as against only £778,250 in 1910; and at the present time the market valuation of nine of them exceeds that of the 40 productive mines in the Central Rand. We refer Mr. Marriott to the bank-books of the trusting shareholders, who, in seven years, have seen their holdings in three of the big consolidations, namely, the Crown Mines, Rand Mines, and East Rand Proprietary companies, diminish in value $204,000,000. The decreased valuation of the very mines to which Mr. Marriott refers so optimistically is suggested by the quotations for the shares of the Rand Mines, Ltd., which, in seven years, has depreciated $52,000,000. Mr. Marriott should propound his fallacy, his grossly misleading fallacy, to the horse-marines, not to an institution of mining engineers.

Sustain the Production of Gold

No official of the Government, no committee in charge of war preparation, no representative man anywhere has ventured to suggest that gold mining is a non-essential industry. The disabilities under which it has labored have, however, been overlooked until recently in the hurry to build ships and to manufacture shells and powder. Even the Treasury Department has been so concerned with the trying task of financing the War as temporarily to disregard the difficulties that the gold producers were facing on account of the enormous increase in costs. Suddenly, however, Secretary McAdoo awoke to the fact that the industry was doomed unless measures for relief were taken promptly. At his request a hearing was given last week in San Francisco by Mr. Ray-

mond T. Baker, Director of the Mint, to the gold miners of California, at which ways and means for saving the industry were considered. Prior to that Mr. McAdoo had written to Mr. Charles A. Sulzer on this subject, making the unequivocal statement that, "at no time has this country so much required the largest possible production of gold as at present. Next to food and ammunition gold is one of the most needed war essentials. In order to face the enormous amount of Government bonds required to finance our war expenditures a large credit-structure will inevitably be erected on our gold reserves, and it is necessary that those reserves, which are the foundation of the structure, shall be maintained on the broadest possible basis." Confirmation of this authoritative opinion has been given by many of the leading financiers of America. The importance of gold mining, therefore, is not being debated; the question is merely that of finding a practical means of fostering it.

The California Metal Producers Association has laid before the authorities at Washington the facts regarding the stress of weather against which the gold miners are contending, and Mr. Charles G. Yale has made a special report on the subject at the request of the Treasury Department. The value of the gold produced in the United States, including Alaska and the Philippines, was $84,456,600 in 1917, being $7,133,700 less than in the previous year. It is estimated that the output this year will decrease 35% unless an effective stimulus be applied. In California the decline in the first six months of 1918 has been alarming. The output was 66,668 ounces, against 89,830 for the corresponding period of 1917. In one of the leading districts of the Californian gold belt the cost this year has increased $1 per ton, against a recovery of $7 per ton of ore. On the Mother Lode, which yields 46% of the total output of the State, the added cost has been nearly as great, and the average recovery is about $4.20 per ton of ore; this shows how the industry is threatened. The difficulty is aggravated by the growing fear among the miners that gold mining is destined soon to end, and, as a result of this apprehension, an exodus of labor to more promising fields has taken place. The first and most obvious remedy that would serve to hearten the gold miners is to secure a definite order from the War Industries Board placing them on the priority list. Some complaint has been made that supply-houses have discriminated against the gold industry by declining to contract for steel and other materials beyond immediate requirements. No industry can prosper if placed on such a hand-to-mouth basis. The War Industries Board should stop this at once. The next problem is to relieve the stress caused by exorbitant prices. Gold, as the standard of reference for all markets, bears an immutable relation as regards a unit quantity of the metal to the unit of exchange. All values, all wealth, all credits, are based on the fixedness of that relation. To tamper with it is to undermine the whole credit structure of commerce and of nations. As we pointed out in a recent issue, the real trouble that overshadows the gold industry is the consequence of mistaken policies at the beginning of the War whereby the profiteer was permitted to escape from Governmental restraint. Only direct and specific remedies will suffice to rescue an industry that already confronts an operating cost as great as the market value of the article produced. Had a more rational plan been followed the disparity between the purchasing power of gold and the cost of its production could have been obviated. The problems of individual and national credit would then have been simplified. It was not done, however, and as one result we now confront a shrinkage of the very basis of our credit. Not only would such a shortage of gold be serious during the War, but it must be remembered that the closure of mines at this time would involve a shortage of gold for many years. Mines that are operating on a narrow margin of profit at all times will not soon resume if forced into idleness. Deterioration of plant and equipment, rotting of timbers underground and collapse of stopes, gangways, and shafts, inevitable under these circumstances, would discourage revival of the industry unless gold were to command a considerable premium. That is an evil from which the Nation may devoutly hope to be spared. The peril of it will increase unless gold mining be sustained. In an effort to escape from the dilemma, proposals are being made that would be condemned as wrong in principle were it not for the serious peril confronting the gold industry. The plan that seems to have gained the larger number of adherents is to pay a bounty of $10, or some would have it $20, per ounce on all new gold produced. The American Mining Congress is urging this idea upon Congress, with the approval of many Western miners. It is a crude and reactionary method, but, for a time at least, it would be effective. That it would prove a relief for the duration of the War, and through the period of reconstruction afterward, is open to serious doubt. It is like keeping a patient alive by stimulants instead of finding a cure. Nevertheless it has something to commend it, whereas the proposal to increase the unit value of gold is a contradiction in terms. That notion seems to have been advanced independently in America and in England. Another suggestion, which must appal sane financiers, is to permit the exportation of new gold to foreign markets at a premium. Such a course would precipitate a panic and would force gold to a premium in our own country. We may mention a much simpler method for relieving the stress, namely, to exempt gold mines from Federal taxes, and to supplement this by according similar exemption from local taxation. On the time-honored theory that gold belongs to the sovereign, this mark of sovereign favor and need, on behalf of the sovereign people of this democracy, would introduce no new and extraordinary principle. It would merely accentuate the distinction of the monetary metal as vitally necessary for the Nation's financial health and for the stability of its public obligations; it would be no more an unfair discrimination than the exemption enjoyed by certain bonds, and it would tend to make gold mining, if not the most profitable, at least a gilt-edged industry.

Gold is Essential

The Editor:

Sir—In your issue of June 29, I am pleased to note that you deal with 'The Slump in Gold.' I need not attempt to cover the same ground that you have so ably covered, but I will deal with another side of the situation.

1. Gold mining in California, and elsewhere, has usually been the pioneer industry from which all other industries have started. So old is gold mining that it has become a part of our national business. Furthermore, the stoppage of gold mining would cause great local dislocation to business, and hardship to those who for several generations have depended upon gold mining for a living. There are thousands of men engaged in gold mining who know nothing else, and to take away the one thing known to them would create great hardship.

2. The investor also should have some consideration, as he has invested his capital in gold mines, expecting to be as well treated as if he had made his investment in any other business. People with money to invest are an asset to the country, and should have the protection of the Government, as without moneyed people the development of our resources would be very slow. This is a question that all must agree is so much in favor of protection, that it is useless to waste time in its discussion.

3. When an industry has persisted for sixty or more years, as gold mining has done in California, it would be a great calamity to the State to peremptorily close down the mines, because it would be as dislocating as if some large cotton-mill in an Eastern town closed down after having been the main support of the community for many years.

The Secretary of the Treasury has already acknowledged that gold is an essential, as you will see from the following letter addressed to the Alaskan delegate in Congress:

"I beg leave to acknowledge receipt of your letter of June 1, in relation to the present conditions surrounding the production of gold in Alaska. I fully appreciate that, with the rising cost of raw material and labor and with a fixed value for their output, the gold miners of the world are facing difficult conditions. I should be sorry, however, if for this reason there were any relaxation in the effort to produce gold. At no time has this country so much required the largest possible production of gold as at present. Next to food and ammunition, gold is one of the most-needed war essentials. In order to place the enormous amount of Government bonds required to finance our war expenditures, a large credit structure will inevitably be erected on our gold reserves, and it is necessary that those reserves, which are the foundation of the structure, shall be maintained on the broadest possible basis.

"The United States and its associates in the War are heavy purchasers of raw materials and other commodities for the War in many neutral countries, and our war requirements make it impossible for us to pay our bills in those neutral countries as we have been in the habit of paying them in times of peace, namely, through the shipment of manufactured goods and commodities which those countries are eager to buy from us. This means that a certain amount of debt to those countries must be paid for in credits or in gold.

"This brief statement will, I hope, make clear to your constituents the great necessity that exists for the maintenance of gold production at the maximum point. The man or the community that maintains or increases its production of gold in the face of difficulties and discouragement is performing a patriotic service which deserves recognition no less than the more obvious but not less useful services that are more in the public eye."

It will be noted that Mr. McAdoo states, "next to food and ammunition, gold is one of the most needed war essentials." This being the case, why should gold miners be awakened every few weeks by a scare report that, as "gold is considered by the Government as non-essential," freight and supplies accommodations hitherto enjoyed would be suspended. At the present moment I am suffering from such a report given out by a representative of an important hardware house in San Francisco, to the effect that his house had instructed him to take no orders from gold mines for iron and steel, as the Government considered gold non essential, and the mines would close down. This report has been spread broadcast throughout the Mother Lode region.

Upon the occasion of my last visit to the Mother Lode mines under my control, I was asked by many of my employees the meaning of the statement, as they were forced to work for a living, and stated that they would be leaving for steady employment, etc. I am responsible for the operation of three gold mines, the Plymouth Consolidated Gold Mines, the Carson Hill Gold Mines, and the Pacific Coast Gold Mines Corporation. The first two are producers, while the latter is being developed on two new levels after sinking the main shaft from 1800 to 2300 ft. We are also trying to build a mill to treat 300 tons of ore daily. It will be seen how disconcerting it is for us to have these reports started from time to time with the result that our labor becomes uneasy and scarce.

I would strongly recommend that gold be given a place in the essential list, and I hope that it may be near the top. There can be no question as to its necessity in greater annual production now than at any other period in the history of the world. Gold has, as you say, depreciated in purchasing power, caused by the War, while base metals have appreciated in purchasing value. There are a few ways that gold can be cared for as it deserves for the good of our country: Place it upon the essential list where it belongs, and remove as much taxation as is within the power of the Government until twelve months after peace is declared. Even this will not compensate the gold miner for his greatly increased expenditure on account of increases in wages and supplies, but he would be quite content if he felt that for all his efforts to produce gold, which is so much needed, he was receiving the recognition of the Government that gold mining deserves.

It is not sufficient for Mr. McAdoo merely to say that we should increase our output of gold. If gold is as important as he says, namely, third on the list of essentials, then why not at once place it upon the essential list and give it the proper rating so that we, as gold producers, may feel that we may expect the same consideration as producers of other essentials. Mr. McAdoo, I am sure, would be surprised if he really knew the true situation regarding our gold-mining industry. Several of the largest producers are running short-handed and are contemplating closing down, while several have already closed down.

It is too bad indeed that the gold producers have had to face these uncalled for fights to maintain our production, but the struggle will be fruitless for us unless we receive the support that we deserve, which Mr. McAdoo admits is due us.

I hope that this question will be discussed in your columns by other producers.

W. J. Loring.

San Francisco, July 5.

In Defense of the Rough-Neck Superintendent

The Editor:

Sir—In the article 'A 10% Tax on Commodities,' appearing in your issue of June 22, a great injustice is done the 'rough-neck,' and the business-man.

In a life-time experience of selling mining machinery, and mining supplies, the aggregate of the transactions running into millions of dollars, the number of times commissions were paid to buyers, or to those who had charge of the buying, could be counted on the fingers of one hand. The average business-man detests the practice of paying commissions. A buyer has to plainly ask for it, before it is paid, and strong hints on the subject are not met. Rather than lose business, a commission will generally be paid, but not always.

Now as to the 'rough-neck,' as you term him. He is the father of mining. My experience does not extend beyond California, but certainly the old-time mine-managers in this State would compare favorably with the best of today. They mined the ore just as cheaply, followed up the ore as intelligently, were well versed in the reduction processes of their day. I was intimately acquainted with William Johns, and William James, who were in the different capacity of manager and superintendent of the different properties of the Sierra Buttes Gold Mining Co., and the Plumas Eureka Gold Mining Co. Mr. James subsequently went to South Africa. Many millions in bullion was extracted from these mines, and more than $5,000,000 paid the stockholders, under their management. J. F. Parks, the superintendent of the Kennedy mine for many years, is another man with whom I was fairly well acquainted. The purchases these men made would run into the millions, but anyone who knew them, knows that a hint at a commission, or so much as a present of a box of cigars, would have been resented in a manner that would have been very uncomfortable. These men are but fair types of many like them, who are dead now, but who worked hard and faithfully for different companies who employed them, and obtained good results.

George W. Starr, superintendent of the Empire mine, at Grass Valley, Webb Smith, superintendent of the Kennedy mines, at Jackson, and Fred J. Martin, superintendent of the Utica mine, at Angels Camp, are the legitimate successors of the men mentioned above. All would come under your term of 'rough-neck', yet their work would compare most favorably with the educated mining engineer, whom your article places on a plane far above.

The business-man of California, selling mining machinery, and mining supplies, is not running around trying to find someone on the staff to pay a commission to, to introduce his goods, and the man on the staff is not looking for the commission.

H. W. Morris.

San Francisco, June 24.

[Mr. Morris has misunderstood our reference to 'rough-neck' superintendents. It is ludicrous in such a connection to mention the names he cites—the names of men that we know and honor just as he does. Apparently he assumed that we class every engineer that is not a college graduate as a 'rough-neck'. This is absurd. The reference was intended for quite another class of men; the low type of smart working-man without character that happens to be lifted to a position of responsibility in a frontier community. It is unnecessary to specify further. For the rest, such men as are cited by Mr. Morris will be the first to agree that the morale of the profession has been raised by the increase in number of those that have undergone a special technical training for their work, because, among other reasons, these include their own sons.—Editor.]

Fluorine is suspected to have been partly responsible for intense sericitization in some copper deposits containing large quantities of chalcocite. The fluorine is thought to have been in the primary mineralization waters.

Mining on the Rand

By HUGH F. MARRIOTT

Introduction. *A presidential address should have for its primary object the dissemination of information in a concrete form, and in considering what should be my subject tonight I was met by the point so often expressed that, whereas the metallurgist can select a process or a plant and construct therefrom a thesis which becomes a standard statement, the miner has no definite line to adopt, for every case he deals with is different. It may be said of metallurgy that success depends upon invention and improvement of process, while in mining, success mainly depends upon past experience. You cannot learn mining from a book.

It has, therefore, occurred to me that the best use to which I could put this occasion would be to follow through some of those points in the history of the Rand with which I have been closely connected during my professional life which do not appear in textbooks or in company records, in the hope that they will be interesting to those who know them, and will also help to direct the action of those who are now only commencing a professional life.

I have had exceptional opportunities for following the course of operations and the growth of the Rand in that the mining house with which I have been connected since 1891 controlled in that year 33.8% of the monthly output of the fields and now has charge of the operations of mines amounting to 49.1% of the output. It is of interest to note that in 1891 the average monthly output was 62,426 oz., or £213,027, while the average monthly output for 1917 was 728,868 oz., or £3,096,035.

Today the mining student who has qualified has opportunities for enlarging his mind undreamed of a quarter of a century ago, but a hard schooling in the practical side of the work remains as necessary a portion of his training as ever. Men fitted for the more responsible positions in the mining world are found among those who have made a success of each stage of a hard-fought youth —not among those whose ascendancy has been like that of the comet. It is the steady record that produces the best results.

The Rand started with very keen man who were bound to progress, not only on account of the success of the industry and of their own natural ambitions for advancement, but the stimulating air of the high plateau was in itself sufficient to convert even a sluggish constitution into a means of rapid thought.

The possibilities of the extensions of the deposit were rapidly grasped and raked from end to end, and, after the 'deep levels' had become an accepted fact, in 1892, the outlying work that has been done since consisted mainly of going over ground that had already been tried again and again.

Where, then, has been the cause of improvement in succeeding years if the main facts of existence have been known for so long? It has been one of method, partly evolved by experience gained locally, and also in considerable measure by judicious introduction of experience gained in other fields and other channels of knowledge in the world. This should be so, for a self-centred isolated community produces in time the same faults that come from in-breeding, not the least being intolerance to outside co-operation and intellect, which only acts to the detriment of those who seek to preserve their insularity. The minds of individuals move rapidly, and the minds of masses move slowly, and it may almost be said in inverse proportion to the size of the masses. We want no more forcible example of the necessity for rapid action and the exercise of individuality as contrasted with the expression of mass thought and movement than the present world struggle.

Let us see how improvement of method has had its effect and what scope still lies before us for further progress. In the early days those mines which started well on rich reefs continued their successful career, and made the fortunes and reputations of many who by foresight or good luck obtained control of them. Then came the steady hunt for gold in the gaps and on the extensions to the proven mines. It is in these directions that science and experience have had immense advantages over the old rule-of-thumb methods of development.

Early Exploration. Following on the results of the prospecting trenches and mining operations from the outcrop, the most progressive method of the early days was to sink boreholes to cut the reef at comparatively shallow depths. The first of these was at the Village Main Reef, where in 1890 the South reef was intersected at a vertical depth of 517 ft. It is interesting to observe that while in those days there was a doubt about the existence of the ore deposit even at this short distance from the outcrop, today it is not considered an undue risk to invest a million and a half in equipping a property in which the reef lies at a depth of 5000 ft., and the major portion of the expenditure has to be undertaken before the reef is cut. The second effective borehole was on the Rand Deep Level ground, and was the first proof of the continuation of the ore below the boundary of the Crown Reef. This was sunk in 1892, and cut the South reef at 823 ft. Intense interest was taken by the community in this borehole, and it was on the results therefrom that the ground immediate to the dip of the working outcrop-properties was recognized as having a definite value.

These early boreholes had a twofold object. The first

*Delivered before the Institution of Mining and Metallurgy, London, on April 11, 1918.

was to prove the continued existence of the orebodies, for in those days, however assured the scientist might have been of the continuity of the deposition, it had to be demonstrated by results to the world at large if the required confidence in the stability of the fields was to be established. The second was to obtain as accurate as possible cross-sections of the reef formation and to furnish material for assays on which to base estimates of the gold-contents of the reefs passed through.

In the first requirement the early boreholes were extraordinarily successful, and as the evidence accumulated it became possible for a skilled observer to determine, from the results brought up, the distance at which the Main Reef series would be encountered to within a few feet. As an indication of the value of the reef the results were not so decisive, but it must not be too readily assumed on the records of past work that no weight can be given to results obtained by this method. On the Central Rand, where the reef formation is compact and lies in hard country, the assay-results from boreholes have in several instances been since proven to be very nearly the average of the reef they intersected; but this again must have been very largely chance, as there are often wide differences between closely spaced min samples. No miner would attempt to value a block of ore-reserves on a single sample.

In the Eastern Rand, owing to the friable nature of the foot-wall of the reef, which portion is also the main gold-carrier, this was often penetrated without previous warning owing to the absence of reliable upper indicators as found in the Central Rand, and as the core was being cut, the hard quartz pebbles often ground up the soft foot-wall shales and dispersed all the fine-gold contents, barely leaving a trace in the core-barrel for the assayer. In the Far East Rand, as in many other cases on different classes of ore, full success has been deferred owing to too close adherence to an assumption of a normal position for the valuable contents.

At the present day it is possible to divert boreholes at some distance above the reef, and to take another section. The exact location of the reef is then known, and the second sample can be carefully drilled. Cores of much larger diameter are now obtainable in this formation by shot-drilling, thus rendering it possible to obtain a more coherent core.

In general it may be said of the returns of values afforded by boreholes that, provided the formation is there, a poor result is no criterion that profitable contents do not exist in the locality. On the other hand, if a rich result is obtained it is extremely improbable that the sample of ore secured haphazard as one solitary representative of a large area should happen upon an abnormally high-grade patch. It is much more probable that the value disclosed will be found to be repeated many times over in the vicinity.

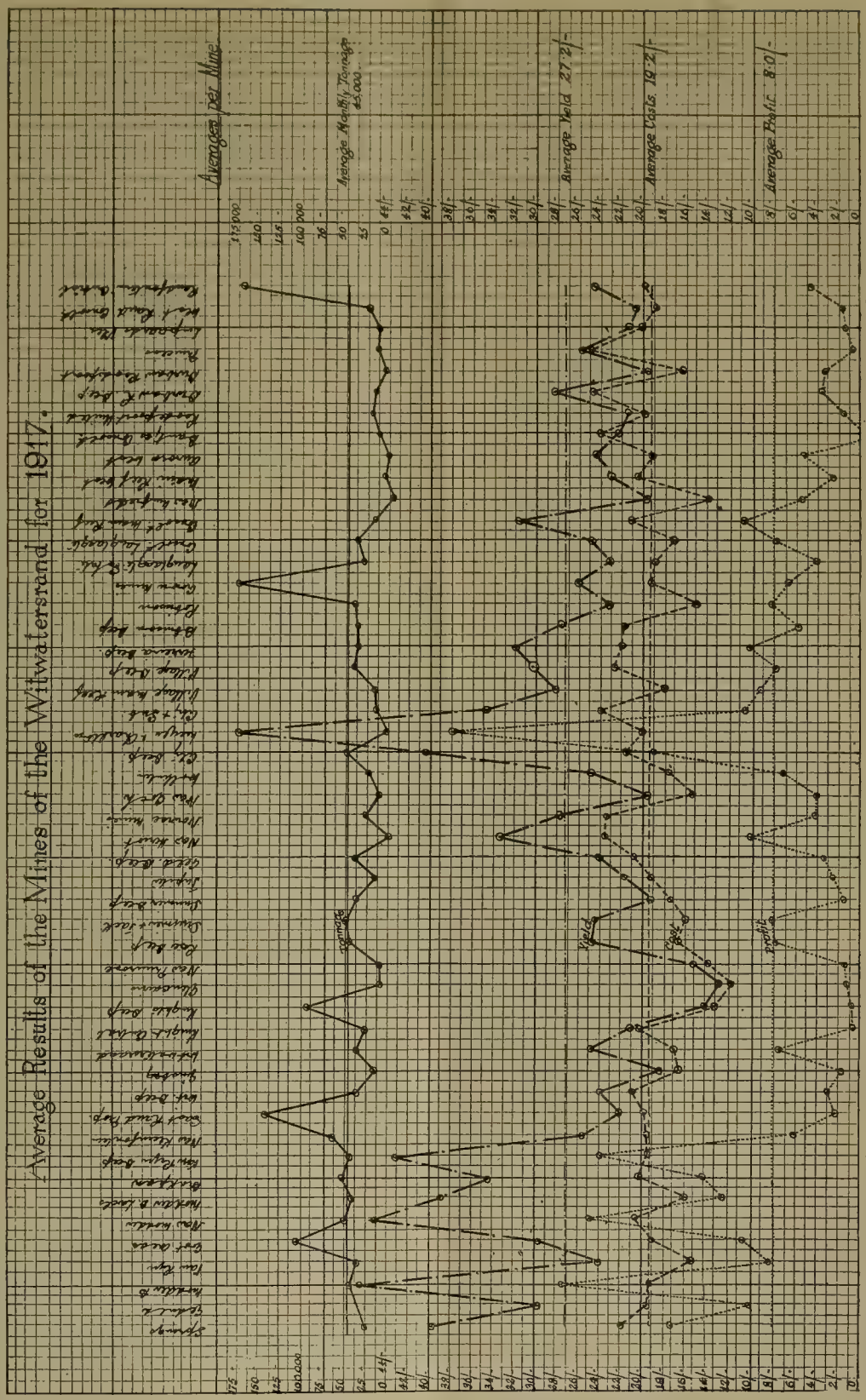
The positions of the reefs at depth having been proved, this indeterminate method of valuation gave way to development by shafts, and then the successful opening up of the rich resources of the Rand at depth commenced in earnest.

Shaft-Sinking. The next step affords material for comparison of present practice with the methods of a quarter of a century ago. Having found the reef and proved its probable character at several points sufficiently widespread, the first shafts were located. The main shafts, which had to do the double duty of prospecting the deposit ahead of the mine and of providing the means of getting the ore out, were then started from the surface either as inclines directly on or under the reef, or as verticals which cut the reef at no great depth, and were there turned off on the underlay and continued down as inclines. These latter, known as compound shafts, have proved to give the minimum of capacity combined with the maximum of expense. The bends seriously restrict the speed of hoisting and shorten the life of the ropes. In addition, the ground above the reef at the bend is usually the weakest in the formation and entails great expense of upkeep.

The incline from surface has much to recommend it, and there is no doubt that in a new mining country it helps to educate the population to underground life by degrees. Timbering is simple to construct and replace; air, water, and electrical connections are more easily attended to; and the ladder-way forms a ready means of communication between the underground workings and the surface, being especially valuable in case of emergency. When the shaft is carried either on or close to the reef, the results obtained during sinking operations are of importance and interest as indicating the future character of the deposit. The chief drawback is instability of the ground as the worked-out areas increase in extent and cause movements which crush the timbers and cause stoppages in the work of the mine. If the shaft is sunk in the foot-wall out of reach of these disturbances, its value as a pioneer in obtaining knowledge of the deposit ahead of the lateral development is largely eliminated.

Recent practice is based on the recognition that it is not wise to try to make the shafts fulfil all these requirements at the same time. The inclines sunk on the reef, while offering the best means of prospecting ahead of mining operations, are recognized as being unstable in character, and only valuable as hoisting-ways until the stopes on the horizon through which they pass are worked out. They are capable of producing all the output likely to be dealt with until the deposit has been sufficiently proved to warrant expenditure in plant on the larger scale. Then, when relative permanence of profitable ore is assured, a central vertical shaft is located and the connections to it so laid out that it can be fed with ore from all over the property, and it will take up and increase its duties as the other channels of supply become inoperative.

How great has been the revolution in mining practice is shown by the fact that before the principle of centralizing the underground transport was introduced, the average number of tons hoisted per shaft per day was 400 tons, whereas now the shafts laid out as described deal readily with 4000 tons in the same number of hours per day, or ten times the former amount. The innova-


Average Results of the Mines of the Witwatersrand for 1917.
Average per Mine
Average Monthly Tonnage 45,000
Average Yield 27·2/-
Average Costs 19·2/-
Average Profit 8·0/-
Tonnage
Yield
Cost
Profit

tion was not evolved from within by gradual changes. The time-honored method of calling for ore at each and every level of the mine as the ore-bins were filled was too firmly established. The change was effected through the appreciation of the fact that the two great branches of mining, coal and metal, were not so far apart as custom had hitherto decreed, and that each had much to learn from the other. The introduction of coal-mining experience to the Rand and the completion of the first example of colliery practice in hoisting from one central loading-station was sufficient to demonstrate the superior efficiency gained thereby, and the system is now the orthodox method of layout of a new property.

One point in connection with the further development of the centralizing system remains to be solved, and is now being tackled in various ways. I refer to the position which arises in the case of a vertical shaft fully equipped which is already dealing with all the ore tributary to it, either from above the horizon of the shaft-bottom or hoisted to it by means of subsidiary inclines.

There are three methods. First, to deepen further the main shaft from the surface, or, if it has already reached its economic limit, to sink a vertical shaft just alongside, so that the ore hoisted from greater depths can be transferred directly from one to the other by trucks or through ore-bins. This will necessitate longer cross-cuts at each succeeding level, and does not assist in providing reef exposures ahead of the subsidiary mining operations.

The second method may be taken to be the sinking of a main incline-shaft under the reef from the bottom of the vertical shaft, the ore being transferred in one operation as above. This has the advantage that evidence is obtainable of the value of the deposit as the work proceeds, and the minimum amount of cross-cutting is required. The chief drawback is the smaller output obtained from each hoisting-way, thus possibly requiring two inclines to feed the main vertical shaft. There is also the risk that the inclines may be affected by movements of ground at a later stage.

The third method has only recently entered the arena, and consists of a cross-cut from the bottom of the main vertical shaft in the direction of the dip and a sub-vertical shaft sunk from this cross-cut in a position suitable to control all the lower ore included in the estimates of future working.

This system of layout is in the first instance subject to the same criticism as the first method, in that it does not offer facilities for ascertaining the value of the deposit till the work is all completed. But when once the reef is reached, and the subsidiary inclines have also been sunk to the horizon of the bottom of the sub-vertical, it may be found that development can proceed more quickly by this than by any other method.

The chief drawback to this system is that the ore is subject to one more transfer than by either of the other two layouts, and this, if it does not restrict the output, must cause a permanent increase in costs of hoisting.

My opinion is that as regards these three methods no endeavor should be made to arrive at a set rule of procedure, but every mine to be equipped should be considered in the light of the special conditions obtaining and the requirements to be met.

This is a case in which the Rand has to lead in mining practice, and the comparative results of the different methods of multiple-stage hoisting will be of great value to all who are engaged in deep mining.

VENTILATION. One factor which has to receive its due weight in considering the problem of mine layout is ventilation. Here improvement in method has altered the whole aspect of mining and has been more instrumental in removing doubts of the practicability of mining at great depths than any other branch of the science.

In the early days of mining, the ventilation was left to look after itself, and as the air below is always hotter, at any rate at some periods of the 24 hours, than at the surface, a replacement of the vitiated mine air by fresh air from the surface must take place, though sometimes very sluggishly.

Coal mines were the first to introduce artificial ventilation, not from any attention to the requirements of the workers, but to remove the dangerous gases given off from the coal.

I think I am right in saying that it was left for the Rand to initiate the installation of mechanical ventilation on a comprehensive scale as an aid to efficient mining from the point of view of supplying an adequate amount of fresh air to the workers.

The old way of looking at the question was—can it be reasonably shown that the minimum air required by the regulations is passed down the mine? Today the question is how much air do we require to ensure that fresh air is provided in sufficient quantity at every working-face so that the workers are naturally induced to put forth the greatest energy at their work. Sunlight we cannot give below, but fresh air that comes direct from the sunlight is the next best insurance of health, and a healthy atmosphere is the best incentive to intelligent work and an increased output.

Recent researches with the action of dry ventilation on the damp surfaces underground have shown that a considerable reduction of temperature is obtained by the evaporation thus set up. The results have been sufficient to demonstrate that a judicious application of this principle will enable the mines to be carried down some thousands of feet deeper than would have been feasible had no means been found to reduce the rock temperatures which gradually but surely increase as greater depth is attained. As it is, it may be fairly estimated that rock temperatures will not be the limitation of practical mining on the Rand.

The health of the underground workers has also been further assured by the regulations enforcing the use of water throughout the workings to lay the dust caused by drilling. The clean pure air of the mines of today is a benefit which can only be fully realized by those who have worked below in the dust and fog of the earlier days of the Rand.

CIRCULAR SHAFTS. A very decided factor in the ca-

pacity of the deeper mines to produce ore by providing ventilation for the workers, and by the consequent effect on the temperature, is the introduction of the circular shaft on modern lines. The rectangular shaft had reached very large dimensions, with seven compartments measuring over all some 45 by 8 ft. With the forest of timber required for its construction, the equipment and upkeep has become a costly matter, and though the output per skip-way has been increased by improved methods of hoisting to very creditable figures, the design remains, of necessity, very inadequate for ventilation purposes. The increasing activity in the Far Eastern Rand favored the practical solution of the question as the flatter formation and the Carboniferous measures in that district are more nearly comparable to the strata in this country in which circular shafts are the normal design.

The advantages of the first examples had only to be seen to be copied, and today there is no part of the formation which is considered unsuitable for this class of construction. The original cost and the upkeep are both considerably less than in the case of the timbered rectangular shafts. They can be equally well equipped for cages or skips, and the ventilation capacity is much greater.

It will be of interest to some of you to refer to the record for circular shaft sinking which was obtained on the Crown Mines in 1916: 246 ft. was sunk in 30 days, from 685 ft. to 931 ft. in depth, and the walling was completed in 6 days more. The new Modderfontein circular shaft, which was completed in 1912 at a depth of 2258 ft., is 18 ft. in the clear and was sunk at an average cost, including walling, of £22 10s. per foot.

Pumping. Another problem has arisen in recent years for dealing with which the circular shaft is preferable. I refer to the passage of shafts through watery strata. There have been cases of excessive influx of water in the course of sinking shafts in the quartzites of the Witwatersrand series. These have been met by the installation of powerful pumps, and notable records of sinking have been done under trying conditions. Today the conditions on the extensions of the Rand are different, and the shafts in their upper portion have to pass through limestone formation in which there exist fissures connected with underground reservoirs which may produce water in overwhelming quantity. This problem is now well on the way to being solved by the introduction and successful application of the Francois cementation process on the fields. After an investigation of the successful application of this method of shutting off water from workings in this country, and the results of sealing up of the high-pressure water-zone on the East Rand, it is not too much to say that it may be relied on to deal expeditiously with any water difficulty that may be met with in shaft-sinking in the future, provided always that it is properly applied.

Underground Haulage. Another variation in the method of mining that has assisted toward economy of working is the method of laying out drifts. This alteration has been largely brought about by the centralizing system of transport. Formerly the drifts followed the reef as closely as the developers could carry it, and afterwards the ore had to be transported over the track with all its drawbacks to efficient tramming on account of the sharp bends and changing elevations. Now the drifts are put in with a view to their use for transporting the ore, and are often carried a short distance under the reef, which is tested at regular intervals as driving proceeds by cross-cuts for sampling purposes.

The methods of transporting the ore along these drifts are many, and will continue to be so, for the decision as to the best system for the purpose depends on the individual conditions at each property.

When a great and continuous tonnage is assured, an independent transport system by means of locomotives and trains of trucks of large capacity may be estimated to repay the large capital expenditure involved in installing the roads and the rolling-stock, but the development ahead should be sufficient to assure that the capital sunk would be more than returned by the saving in working expenses before schemes of perfection of this nature are undertaken. Endless ropes and main and tail haulages of the designs well known in colliery practice are now generally applicable in mines where the transport service can be laid out along defined lines. They have the advantage of a less expensive road-bed, the use of trucks in normal mining use, and are not limited closely in gradient.

There are cases, even where very large tonnages are involved, in which it is found that gangs of tramming-boys working under a properly controlled system will transport the ore along the levels for long distances at a cost which is so little in excess of that of mechanical haulage that the installation of a power-driven plant is not justified. This method has of course the advantage that the labor force employed is movable at will to any part of the mine. The choice from all these various systems must be governed by the amount of ore to be collected within their range of action and the period over which it is to be worked. Any system of mechanical transport when working considerably under its rated capacity is uneconomical.

The alternative methods of carriage of ore to the surface have not yet had that amount of consideration paid to them which will have to be done when the deposits of ore to be worked are more restricted and more difficult of access, and the profit available from each individual section or block in a mine is more closely calculated. I refer to the question of skips and cages. The skip can more conveniently take the larger tonnage per trip—it can be rapidly loaded and discharged with little extra labor requirements. On the other hand, it is fed from ore-bins which must be of large capacity to meet the needs of the mine. They are expensive to construct and are only useful for the particular section immediately above them. All the different classes of ore that are dumped into them are mixed together and go to the mill as one product. Too often no separate arrangements are made for the disposal of the waste-rock that is produced

in mining-work off the reef, and this also is dumped into the ore-bin, and then has to pass through the treatment plant with the valuable material, thereby adding to the cost, occupying valuable space that might be used in earning profit, using up labor and skilled attention in eliminating it at the successive stages of treatment, and sometimes rendering the actual process of extraction more difficult.

There is nothing in the world more misleading than the figures which can be compiled, and often with every appearance of accuracy, to show that rock which contains gold of less value than the normal cost of extraction can be made to produce a profit. If it is found after the closest critical examination that this is the case, then it can also assuredly be found that the anomaly is due to the disproportionate layout of some portion of the mine or plant, and the proper procedure is to remedy the defect at the source and readjust the proportions, for it is only thus that the true object of mining is attained, namely, to get the greatest profit out of the deposit being worked.

There are many in all branches of the profession and mining business who can never free themselves from the glamor of gold. It cannot be too often reiterated that it does not pay to extract gold from rock of the value of a sovereign if the cost of getting it is 20s.6d., and yet how often is it not found that mining accounts do not include all the current charges against the company's operations and therefore the pay-limit is taken at too low a level and the shareholders suffer loss. This appears to be a digression, but it is so closely interwoven with the argument on the methods of transport of ore which otherwise is restricted to a comparison of direct costs of each system, that I have left it where it comes in logical sequence.

As against the mixed ore supplies from the mine ore-bins, cage hoisting includes some distinct advantages. Ore from any one stope or section of the mine, or even from any one portion of the reef in the stope if mined separately, can be labeled and transported to the surface, passed through the crushers, and carried on to a separate section of the mill where the actual contents can be closely gauged by sampling the issuing pulp. In older practice the actual amalgam from any one section of the orebody thus treated could be obtained in the mill, but with the more recent methods of placing the plates in a separate building this is no longer possible.

Another advantage is the disposal of the waste already referred to, as the trucks containing this would be diverted to the waste-dump, and at a minimum of expense. This alternative involves the capital cost of a larger number of trucks which thus act as storage capacity in place of the bins. It also involves the enlargement of the mine-workings in the vicinity of the shaft so that there is sufficient truck accommodation to ensure continuous hoisting as required. Cages have also the advantage that men and materials are more easily conveyed in them than in skips.

I have said enough on this subject to show that the question involves far more than the mere figures of cost of installation and working, and an investigation of the comparative merits of each system as affecting the whole method of mining and treatment would often prove of value to an engineer engaged in laying out the development and treatment plant of a new property.

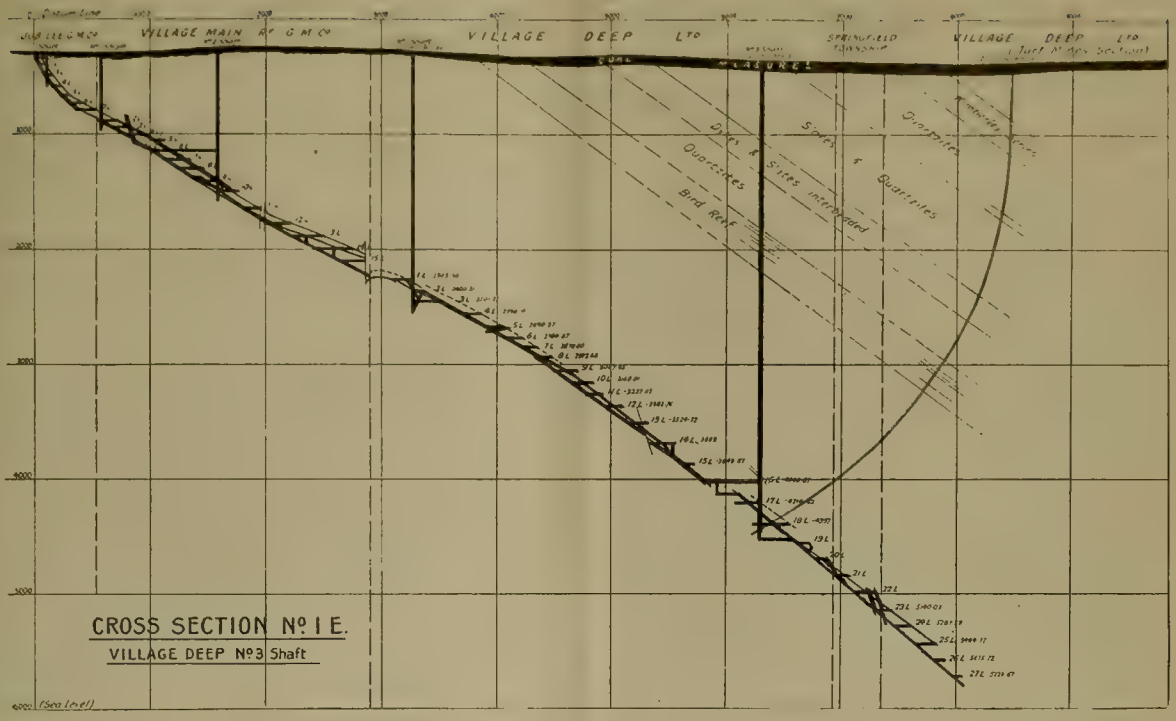
Sampling. In sampling and mine valuation there is no radical change to record. Mine samples are taken at closer intervals than used to be considered sufficient, but, on the other hand, owing to the greatly increased dimensions of the blocks of ore constituting the reserves each sample has a greater responsibility, and the greater number will tend to lessen the effect of errors. A review of the last six years shows that the gold extracted in treatment is about 92% of that estimated in the first instance to have been in the ore as blocked out. This estimate cannot be taken too literally owing to the inclusion of development rock, and the varying widths of stopes.

There is still a missing link in the chain of evidence of ore values in that the valuation of the ore as stoped cannot be said to have a definite relation to the ore delivered into the mill-bin, and this connection will probably not be satisfactorily made until the ore sent to the mill is weighed and sampled on a sufficient scale to secure comparative accuracy. In this event this valuation would be the starting-point to correct the estimates made both for the original reserves and the finished product. The system of truck-hoisting already referred to would go a long way toward removing the remaining discrepancies.

Mining. Of stoping it may be said that as an art it is dying out. The old miners who knew their work by intuition are disappearing, and the great numbers of men who have taken to underground work owing to the increasing output have not had the long training necessary for the best efficiency. As a science it is difficult of investigation—there are not enough constants. The best that can be done today is to divide the work up between several skilled supervisors, each of whom has sufficient time to keep continually in touch with every one of the stopes allotted to him. It would be his particular business to learn the characteristics of the ground being broken, and to vary the system employed, when by so doing an increased profit is shown by trial to be obtainable.

Methods of stoping are now often closely connected with sand-filling and waste and reef packing, particularly so in the Central Rand, where, so far as the upper portion of the mining area is concerned, the withdrawal of support due to the progressive extraction of ore has been followed by an equally progressive settlement of the superincumbent strata which sometimes comes into action with detrimental effect on the mine-workings.

To meet this situation as it developed, sand-filling was introduced in 1908. Previous to this date some of the older mines close to Johannesburg had been showing signs of movement, and it became evident that preparation was necessary to meet this tendency, which was bound to increase in intensity as mining progressed.



CENTRAL WITWATERSRAND, INCLUSIVE AVERAGES OF ALL MAIN REEF LEADER DEVELOPMENT.

Gold Contents in Shillings over the Stoping Widths.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	Distance on dip.	Average.
24·00	26·60		55·20	75·13	100·24	69·45	46·89	42·00	27·00	41·55	27·81	57·35	24·24			33·10	33·00	31·10		ft. 0 to 1500	44·666
	35·27				66·74					32·12		40·79					32·40				
21·00	21·20	27·13	32·24	48·50	47·13	49·20	49·50	31·27	19·00	26·24	18·24	62·45	22·68	26·81		24·31	20·81	24·24	20·65	1500 to 3000	31·190
	25·39				45·12					21·16			37·31				30·01				
	28·30	26·26	35·82	30·22	46·45	47·17	40·84	36·25	32·22	33·71	44·30	62·33	64·46	37·17		20·12	19·73	24·77		3000 to 4500	37·067
		30·13				40·19				36·74			54·65				21·54				
		20·00	32·66	26·47	31·70	45·30	28·44	28·70	25·16	22·89	44·00	29·64	46·17	44·92	31·10		29·33			4500 to 6000	32·432
		26·33				32·12				30·68			40·25		30·21						
				19·33	31·37	36·00	18·12	32·23	27·60	32·00	48·00	21·50	27·90	36·75	27·00					6000 to 7500	29·817
						27·41				35·87			28·72								
									24·88	26·54	40·40									7500 to 9000	30·606
										30·70											

Crown Mines. City & Sub. Wolhuter.

L. Deep Sect. C. Deep Sect. Robinson Deep. Village Deep. City Deep. Nourse Mines.

Total Average 34·192

← 40,000 ft. →

Total Average excluding Outcrop Zone · 32·222

The coalfields of Silesia formed a good object lesson in the support of overlying ground, and, after the methods employed there had been studied, a similar system was introduced on several of the mines on the Rand. This consisted briefly of the hydraulic transport of sand from the surface down to the stopes through pipes, returning the water by pumps specially installed for the purpose.

Filtration difficulties arose on the Rand which had not been experienced in Silesia. The tailings which are employed for the purpose are composed of extraordinarily hard and sharp quartz grains, and the pipes through which they were lowered in the shafts were cut through in a very short time. Various linings were tried at the points most affected, and progress was being made on these lines which bid fair to overcome the difficulty. Confidence in the efficacy of the sand-filling process had, however, in the meantime become more established, and the more stable method of sinking boreholes of several inches diameter for lowering the sand was being undertaken. It was feared at first that choking might take place, causing long delays, but this was found not to be the case, and after more experience was gained it was found possible to reduce the percentage of water in the mixture largely below the proportions which had been adopted at the commencement from the Silesian practice. This lessens the quantity of water to be returned, and thus considerably reduces the main item of cost.

Boreholes have now been sunk on several of the mines, the deepest being at the City Deep, where a borehole of 7 in. diam. was sunk to a depth of 2000 ft. by means of the shot-drilling process.

It has been found that after the earth pressure comes on the filled areas, the sand is compressed to a greater degree than had been previously estimated for from Silesian results. It is not yet clear whether this is due to the greater pressure exerted, to the difference in the filling material, or to a variation in the method of hydraulic settlement. The effect is that the overlying strata are not immediately supported in their original position, but break away to some extent, thus permitting a certain amount of movement which is subsequently arrested.

Waste-packs are largely used as supports, and their construction has been highly developed on scientific lines. They are, however, subject to a much greater degree of compression than the water-borne sand, and consequently allow of subsequent earth movements of greater intensity.

For purely local purposes the control of the pressure by means of waste-packs or broken ore has been found effective, and indeed has largely assisted stoping operations by loosening the ore in the faces, but from the more general point of view the policy should be to support the whole mass of the ground over the reef to the greatest extent possible in order to protect the deeper mines from the undue pressure which otherwise might be caused by subsidence in the upper areas.

It is found that the areas of disturbance caused by mining operations are largely localized by the great dikes which traverse the reef-bearing strata in all directions. The existence of these breaks, together with the modifications being made in mining practice to suit the changing conditions, should form a sufficient safeguard against any but purely local breakaways.

All these references which have been made to past and current practice are necessarily only of the nature of headlines, but I trust that the description is sufficient to illustrate to engineers who are interested in one or other of the subjects the lines on which they can make further inquiry to meet their particular needs.

Time will not permit of reference to several other branches of mining work in which improvement of method has assisted in arriving at the degree of efficiency obtaining today.

The notable advance made in the mechanical and metallurgical sections of the industry have received due attention by the vigorous and progressive technical societies on the fields, and many a specialist either in mining machinery or in metallurgical practice who has turned his attention to the Rand has modified his first enthusiasm for his projected innovations when he has learnt the amount of research that has already been paid to his favorite subject and the reduced scope that still remains for further improvemeent. This does not mean to imply that perfection has by any means been reached, but that the further improvement of the future is more likely to be attained by close attention to details on the part of those who have an intimate knowledge of the local conditions than by startling surprise involving radical alteration of method.

Organizations of staffs and centralized control of the purchase of stores have materially assisted in the success of the industry, and are rightly included in records of improvement.

Production and Profit. We now come to an interesting part of the investigation, namely, to what extent have these methods of improvement been responsible for the enhanced prosperity of the goldfield, and to what extent has any variation in the gold contents of the ore deposit affected the industry? To answer these questions has required the compilation of figures of some magnitude, but if you will follow me through to the conclusion I think you will find that the results arrived at have repaid the effort.

Previous to the South African War the official publications dealing with returns from the Witwatersrand goldfields did not extend to a statement of the average rate of yield, cost, and profit for each year. Neither is this a very important omission, as the methods of arriving at costs and profits were many and various and often did not reflect to any useful degree the figures that were ultimately required before the divisible profit, which is the only true profit, could be ascertained.

So far as the records have been traced, the costs in the last few years of the 19th century were not far removed from those which obtained during the first years in which normal working was resumed after the war, and these may therefore be taken to represent the earlier standard for general purposes. From 1902 to the present date the

averages for the whole Rand are available, and they are as follows:

	Total tons milled	Yield s.	d	Costs s	d.	Profit s	d.
1902	3,410,813	42	0	25	9	16	6
1903	6,105,016	39	8	24	9	14	11
1904	8,058,295	38	6	24	4	14	2
1905	11,160,422	35	10	23	6	12	6
1906	13,571,554	34	6	22	2	12	6
1907	15,523,229	33	11	20	10	13	3
1908	18,196,589	31	5	18	0	13	5
1909	20,543,759	28	11	17	1	11	6
1910	21,432,541	28	6	17	7	10	6
1911	23,888,258	27	11	18	0	9	7
1912	25,486,361	29	0	18	8	10	0
1913	25,628,432	27	9	17	11	9	6
1914	25,701,954	26	6	17	1	9	0
1915	28,314,579	26	3	17	5	8	5
1916	28,525,252	26	8	18	1	8	2

To those unversed in the practice of mining, these figures might, in the bald state in which they are presented, lead them to the conclusion that the ore in the deposit had depreciated in value as the mines were extended. But to those who are acquainted with the inner conditions, the only positive evidence that is afforded by this statement is that, whereas in 1902 the costs were 25s. 9d. per ton milled, only ore above this figure could be worked at a profit, while in 1916 all ore which gave a yield over and above 18s. 1d. came into the same category. The result of the lowering of the cost has been that not only have the fresh developments of lower-grade ore above the reduced pay-limit been included in the reserves and sent to the mill in due course, but, as each drop in cost has been attained, ore which was previously standing in the upper levels has been taken into the official calculations of ore reserves, which have thus had two sources tending to lower their average grade. Herein lies one of the weak points of the system of keeping records on the variable basis of 'per ton milled.'

Had the returns of new development always been issued as gold contents per unit of area of ground developed, be it foot, yard, metre, fathom, or claim, the successive annual statements of ore reserves would have been comparable and the improvement in methods of mining recognized at its true value, as it would have been shown at once in the reduced costs of working each unit of area.

As the annual yields from the various mines are thus shown to be of no value in arriving at comparisons of the gold contents of the successive zones opened out at the mines are deepened, it has been necessary to construct a new compilation of records practically from the grass roots. Taking into account the many interests concerned, and the varied methods of keeping the earlier records, the inclusion of the whole 55 miles of mines of the Rand would have been infeasible. Further inquiry has also shown this to be unnecessary.

The Central Rand was at the commencement the hub of the industry and has remained so till today. The mines are connected together in one continuous network, and in the centre of operations the Village Deep main shaft has attained the greatest depth in Rand mining, namely, 5350 ft. vertically from the surface and 9800 ft. from the outcrop measured on the dip of the reef. This section of the Rand may be taken for the present purpose as stretching from the west boundary of the Crown mines to the east boundary of the Nourse mines, and measuring about eight miles along the outcrop.

Richness of Ore in Depth. In order to ascertain the original value of the deposit from which the major portion of the gold has been obtained, I continued the compilation which I had the pleasure of exhibiting to some of you in 1914, and it is now completed, as far as it is possible to obtain the details, up to the end of 1916. The reason for which this work was originally undertaken was to obtain concrete evidence of the form finally assumed of the various gradations of the gold deposition, and in this it has usefully served its purpose. As you know, the times are difficult both for private work and also regarding supplies of paper, but I am glad to have been able to have had printed a limited number of copies of a reproduction of the plan. Copies are before you tonight, and you will see that the key to the gold-values denoted by the colors is included on the sheets so that each of you may study the record and draw his own conclusions.

This plan shows the original gold contents of the Main Reef Leader in the Central Witwatersrand as disclosed by mine development operations. The extreme eastern portion, which does not affect the main conclusions, has been omitted owing to printing limitations. The Main Reef Leader was chosen for the purpose as being the most important and consistent gold-carrier, and in offering the advantages of a greatly extended continuous series of exposures for correlation.

I have made a close study of this plan for some years, and have from time to time made forecasts of the future prospects of the deeper levels and have compared them later with the actual results of development. I have never yet been able to ascertain from this accumulating evidence any general indication of depreciation of the gold-values at depth, and my reading of the plan now placed before you is that the same conclusion holds good today.

In order to demonstrate still more clearly the final results of the great mass of evidence which has been brought together to construct this map, the original assay-records have been compiled into blocks of equal area over the whole district. These are set forth in the statement on page 83.

These block-values include all the original sampling results, both payable and unpayable, and may therefore be taken as representative of the original gold contents of the deposit. Next, the average results of larger sectional areas have been compiled from these blocks with a view to providing comparative figures at depth over as nearly as possible equal distances along the strike. Then the whole of the recorded results have been averaged to give one figure of value for each horizontal zone. These have been taken for the purpose of convenient calculation in successive depths of 1500 ft. measured along the dip of the reef. Finally, these horizontal valuations are averaged into one grand total average for the whole of the mines included in the calculation.

It will be seen that the outcrop zone records a considerably higher average gold content than the remainder. This was only to be expected, as it includes all the results

of secondary enrichment which form the residue from denudation, which must have amounted to some thousands of feet.

In order, therefore, to arrive at a final result for the purpose of comparison, the outcrop zone should be omitted, and if this is done it is seen that the average gold-content of the Main Reef Leader of the Central Witwatersrand as disclosed by the original valuation was 32.22s. per mine-ton. Now let us see what bearing the individual zone results have on this figure. The uppermost or second zone on the list is 31.19s., and the lowest or sixth zone is 30.60s., a remarkable degree of approximation when it is noted that they are separated by nearly a mile of workings on the dip.

In the third zone a remarkable rise of the gold-content is noted, which falsified the predictions of many who based their estimates on a descending scale from the mines immediately above, and on the records of gold mines in other localities which have since been proved in no way comparable to the unique occurrence in the Transvaal.

The remaining two zones, the fourth and fifth, closely approximate to the general average, and indeed the whole series of averages now set forth show so little variation in gold-content for the different horizons that scepticism would be expected were it not that the figures are founded on fact carried to the minutest detail.

If any further corroboration of these decisive results should be needed, it is given by the crushings from the mines included in the calculation since the commencement of gold production. The total results for the Central section to the end of 1916 are:

Ore treated, tons	93,468,055
Yielding gold to the gross value of	£170,463,923

or at the average rate of 36s. 6d. per ton milled.

When due allowance has been made for sorting, this is seen to be an extraordinarily close confirmation of the original valuation of 34.2s. for the ore as it stood in the mine, a credit to the accuracy of the samplers and to the ingenuity of those who have been charged with the extraction of the gold.

From the commencement of gold production to the end of 1916 the results for the whole Witwatersrand are:

Ore treated, tons	311,755,786
Yielding gold to the gross value of	£492,364,791

or at the average rate of 31s. 7d. per ton milled.

The total tonnage and yield from the Central Rand represent respectively 30 and 34.6% of the totals for the whole of the Witwatersrand, so that it may be fairly claimed that the conclusions of this investigation can be applied to the whole extent of the deposit covered by mining operations. These figures are conclusive evidence of the stability, consistency, and continuity of the Rand deposits as gold-carriers for all practical purposes.

A further encouraging feature in support of the prospects of the next deeper zones below those already opened out is the number of points at which high-grade ore has been exposed in the deepest workings.

It is thus seen that the gold-contents of the deposit have remained remarkably constant throughout the whole life of the Rand, and that the extension of mining operations and the steady growth of the industry are almost entirely attributable to the improved methods of mining and treatment that have been applied as a result of persistent and progressive research.

The problem today is—what is the best method of working the deeper levels now being entered upon so that the greatest profit is obtained for the shareholders of the mines concerned?

A study of all the evidence I have placed before you lends weight to the opinion, which has already some adherents, that the mode of deposition of the gold in the Central Rand will eventually be found to be not so far removed from that which has been more rapidly proven in the Far Eastern Rand, and that the richer portions of the deposit, while retaining their grade, will be found to be segregated within more closely defined limits. Enquiry should therefore be conducted on lines which will lead to a better knowledge of the characteristics of these channels, lenses, or aggregations of richer ore, and, when located, development should be laid out so that the complete blocking out of ore-reserves should only be carried out in those areas which have been shown by the preliminary driving operations to give undoubted profitable results, while the poorer stretches of country should be intersected by the minimum number of levels considered requisite to prove their low-grade character. In other words, the program should be selective development where the money spent in opening up new mining ground should be devoted as far as possible to the more likely areas, and the sections which offer but small promise of profit should have sunk in them only sufficient expenditure to prove their limitations. This is no new theory in mining, but it has not yet been applied to the older established mines of the Rand. It will necessarily follow that tonnage outputs will be restricted.

The diagram showing the average monthly tonnages and the yield, cost, and profit, with the averages per mine, for the mines of the Rand for 1917 will repay careful study. In character it bears out the deductions made from those similarly constructed for several preceding years. The chief points that stand out are that large tonnage outputs do not necessarily carry with them low working-costs, and that high yields give high profits. It follows, therefore, that the chief endeavor should be to raise the yield per ton from each mine as high as is consistent with the average grade of the definitely profitable ore in the reserves, and to modify the organizations and the scale of the treatment plants to suit the output under these conditions. The evidence now before you leads to the belief that the more general adoption of this policy will be attended by a greater measure of success.

Here, then, we can leave the future to bring what it may, fully assured that behind the average returns of the mines which represent the practice of today there exists a reserve force in the continuance of the high-grade ore at great depths, which, while it brightens the speculative outlook of the mines more directly concerned, may be counted upon to uphold the reputation of the Rand goldfields for a long time to come.

Cascade Method of Froth Flotation

By W. A. FAHRENWALD

During the past few months I have been experimenting with a cascade machine which I believe to be new and which perhaps will be of interest to those working along this line. In cascade flotation the froth formed is the result of agitation and the entraining of air produced by causing a stream or jet of pulp, or rather an ore-water-oil mixture, to be injected into the main body

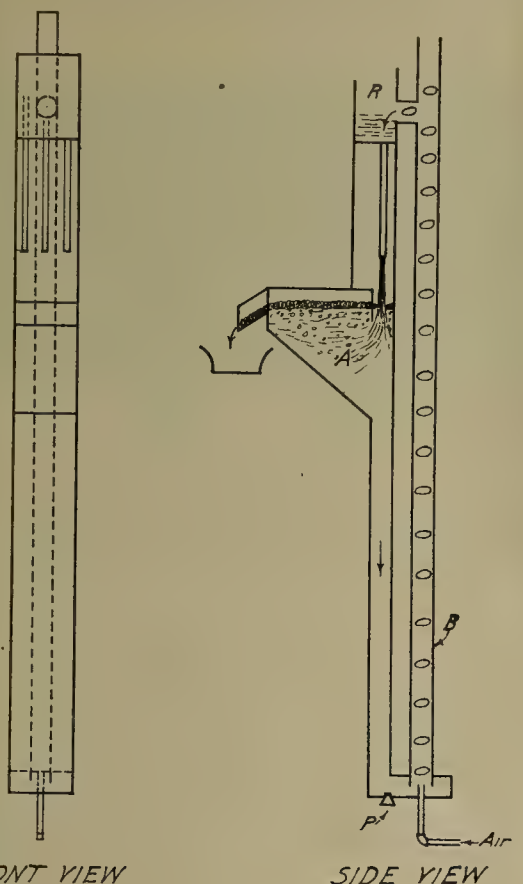


FIG. 1

of pulp. The agitation may be caused by natural gravity, or by artificial means such as centrifugal pumps. By the first method a considerable drop is required between cells in order to impart sufficient force to the stream of pulp. This requires a great deal of head-room in the mill, and necessitates raising the pulp to the uppermost cell. If the second method be used little head-room may be required, but the cost of repairs on the pumps is considerable. Also the first method requires little attention when once installed, while the pumps require more.

The apparatus shown in Fig. 1 and 2 was designed with the object of eliminating mechanical appliances for giving velocity to the jet of pulp and to minimize the head-room required. Fig. 1 shows a sketch of the test-machine used, which is self-explanatory. It consists of a spitzkasten *A*, which extends downward to afford sufficient submergence for the use of the air-lift *B*. The pulp is elevated considerably above the spitzkasten into the small reservoir *R;* from here it is injected into the main body of the pulp by gravity, through three small pipes

FIG. 2

arranged step-like as shown in the front view of Fig. 1. The pulp circulates in closed circuit as shown by the arrows. Pulp may be drawn off at any stage of the test for assay through the plug *P*. I have obtained results with this test-machine that compared well with what could be secured in a mechanical frothing machine, using the same ore.

A convenient arrangement for a commercial size machine, working on the same principle, is shown in Fig. 3. It consists of seven cells, that is, 14 spitzkastens back to back. The feed enters the first cell through the intake pipe *S;* from here, by means of four air-lifts *a, b, c, d,* as shown in cell No. 4, the pulp is lifted to the reservoir

R and thence through the three pipes *x*, *y* *z*, into cell No. 2. This cycle is repeated throughout the series of cells, thus affording numerous chances for each valuable mineral particle to be floated. With this machine no drop between the cells is required; hence the head-room necessary is small. As there are no wearing parts, the cost of operation would be that required for air only. The slender portion of the machine (*m*, *n*, *o*, *p*) could be

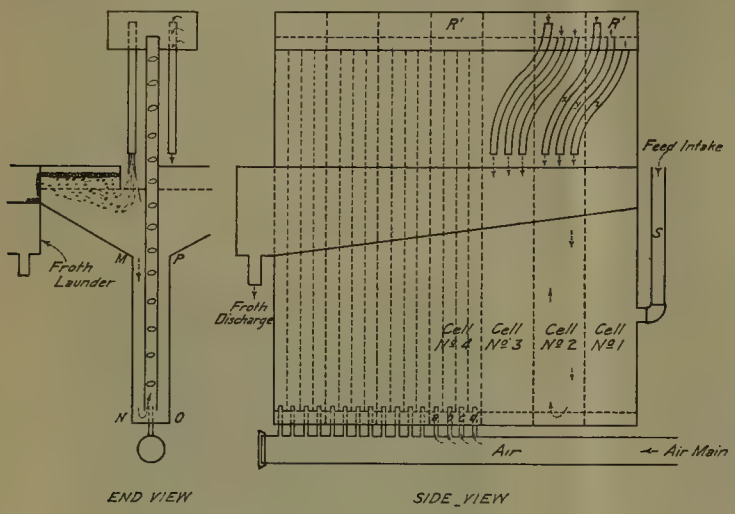


FIG. 3

situated in a trench, and several of these machines could be placed side by side, giving a large capacity per square foot of floor-space. A head of four or five feet of water can be obtained easily, which gives considerable force to the jet of pulp, and produces good agitation and aeration.

MINING COMPANIES using motor-trucks in cold weather are often bothered with water freezing in radiators. A careful study into anti-freezing compounds by the U. S. Bureau of Standards leads to the conclusions that (1) calcium chloride compounds should be used with caution, if at all, on account of their corrosive action; (2) kerosene or similar oils should not be used on account of their inflammability, high boiling-point, and effect on rubber; (3) mixtures of glycerin and alcohol can be used, but the price of glycerin and the need for it in the manufacture of munitions at the present time should preclude its use; (4) solutions made from either wood alcohol or denatured alcohol seem at the present time to be the most desirable anti-freezing solutions to use. If the wood alcohol is free from acid, there is little choice between the two alcohols. Wood alcohol costs more than denatured alcohol and is more volatile, but its lower freezing-point allows a less amount to be used, which may counteract the above disadvantage. The ideal anti-freezing compound is one that will prevent freezing of the radiator liquid without injuring either engine or radiator, that will not lose its non-freezing properties after continued use, and that does not materially change the boiling-point of water when dissolved in it.

Ribbon Zinc as a Substitute for Brass

Before the Government fixed the price of copper and when that metal was selling as high as 34c. per pound, endeavors were being made by those whose prosperity depended on marketing alloys of copper and zinc or copper and tin to find substitutes. About this time a company put on the market a substitute for sheet brass called ribbon zinc, and it was given a trial. In spinning shallow canopies, say about 2 in. deep and about 4 in. diameter, it is fully equal to brass. When attempts are made to spin it to a depth of 4 in. it will not stand annealing, but cracks. This also occurs in shallower shells if spun into a small diameter making a pronounced neck. Considerable of this metal has been used in spinning rings for holding glass dishes, or bowls for close ceiling lights, and fixtures which are suspended by chains. These are all diameters from 8 in. upward, but do not run much over 2 in. deep. In the manufacture of hall and vestibule lanterns, which is hand-work exclusively, ribbon zinc has proved an excellent substitute for brass. After being laid out and cut, the parts are soldered with the same ease, and the completed frame is as firm as in the case of sheet brass. In the manufacture of lighting fixtures the new metal has proved successful. It takes a heavy copper plate, after which it is possible to apply any oxidized finish, whether it be a Japanese bronze or an antique brass. If a white finish be desired the enamel can be applied direct. Other manufacturers are finding uses for ribbon zinc and it will probably develop a field for the consumption of zinc after the War as well as at the present time.

CRYSTALLINE GRAPHITE for making crucibles should contain as high as 85% of graphitic carbon and should be free from mica, pyrite, and iron oxide, which are particularly harmful impurities. It should also preferably contain a large proportion of flakes one millimetre or more in diameter, so that its fragments may interlock and thus be more easily bound together by the clay with which it is to be mixed. Most makers of crucibles prefer to use a mixture of Ceylon graphite with American flake graphite, as the former is more nearly free from impurities and its more nearly cubical fragments have a much smaller surface area in proportion to their volume than the thin flakes of the domestic graphite, so that it requires the use of less clay as a binder. Domestic flake graphite may be used alone for making crucibles.

FLUX for welding high-speed steel to other steel or iron, consisting of 40% bicarbonate of soda, 40% carbonate of soda, 10% sodium borate, 5% precipitated silica, and 5% lithium carbonate was recently granted patent No. 1,256,420, to A. F. Beaulieu, of Chicago.

Making Ferro-Manganese in California

A natural development for the Pacific Coast is that of electro-metallurgy. In California, particularly, there are ores suitable for reduction and water-power available for electric energy, much of it as yet undeveloped. The use of electric furnaces in this State is not new, three having been operated in Shasta county by the Noble Electric Steel Co. for several years. There is a fair demand in the West for alloy metals, but in the East the demand is enormous.

A new company to take advantage of these favorable conditions is the Pacific Electro Metals Co. Its plant is at Bay Point, 30 miles east of San Francisco, on the bay. It is easily accessible, having three railroads close-by, also water transportation. The company is now operating a 40-ton silico-manganese furnace, and will in the near future have a furnace making ferro-manganese. Each of these furnaces has a capacity of 3000 kw. In addition, three 300-kw. furnaces are being erected; in which ferro-nickel, ferro-molybdenum, ferro-chrome, and ferro-tungsten will be made as the raw materials are available. The main buildings are of reinforced concrete. The main furnace building is 120 ft. long and 50 ft. wide. The transformer-building is adjacent to this and is also of concrete. The necessary cooling and packing rooms for the alloys, as well as machine-shop, store-room, wash-house, office, laboratory, and gate-house are all placed in close proximity to the furnace building. The electric furnace in which silico-manganese is made is a three-phase furnace with an open top. The raw materials are fed by shovel around the electrode, and the metal is drawn from a tap-hole at the bottom of the furnace. The operation of smelting is continuous. The electrodes are of 24-in. diameter. The load-factor of an electric furnace should always be good, and the power-factor, owing to the careful interlacing of the leads, is also high. The transformer equipment for one furnace is composed of four single-phase 1000-kw. transformers, one of which is a spare.

To make the plant self-contained and non-dependent on outside sources for electrodes, a plant has been erected and local raw materials are utilized. This building is also of concrete, holding the necessary baking-kiln and apparatus for making electrodes. The directors of the company are C. D. Clarke, San Francisco, president; J. M. Kroyer of Stockton, vice-president; Henry Koster, San Francisco, treasurer; and C. F. Potter and J. W. Beckman of San Francisco. Western capital exclusively is represented in this undertaking. The plant was designed by the Beckman & Linden Engineering Corporation of San Francisco, consulting engineers to the Pacific Electro Metals Company.

PHOTOGRAPH SHOWING LEADS, ELECTRODE, AND ORE OF SILICO-MANGANESE FURNACE, BAY POINT, CALIFORNIA

SILICO-MANGANESE FURNACE IN OPERATION AT BAY POINT, CALIFORNIA

A TOTAL computed lumber-cut for the United States in 1917 of 35,831,239,000 ft. is announced by the Forest Service. This is based on reports received up to May 15 from 16,408 sawmills out of the 24,815 believed to have operated last year. It is estimated that the actual cut in 1917, on the basis of compiled figures, was 10% less than the production in 1916. The falling-off during the past year is attributed principally to largely decreased private building operations, the scarcity of labor in connection with small operations, transportation difficulties, curtailment of demand on the part of wood-using industries, and a more or less general dislocation of lumber distribution through ordinary channels of trade. A considerable portion of the total quantity produced was utilized in meeting the exceptional demands for Government construction and other war emergency projects, including ship material. The State of Washington was again the largest producer, with a cut of 4,570,000,000 ft., Louisiana was second with 4,210,000,000, and Oregon third with 2,585,000,000 ft., crowding into fourth position Mississippi with a cut of 2,425,000,000 feet.

MICA to the extent of 1,216,816 lb. was marketed in this country last year. Sheet mica has become an important war-material, especially in condensers, magnetos, and spark-plugs, in the windows of gas-masks, and for windows in armored cars, and the conning towers of warships and submarines. The prices rose nearly 20% over those obtaining in 1916, the quotations ranging from 18c. per square inch for pieces 2 by 3 in., down to 9.4c. in pieces measuring 8 by 10 inches.

The Price of Mining Explosives

In his annual address to shareholders of De Beers Consolidated Mines (diamond producer), the chairman of directors, Capt. Francis Oats, made sundry interesting remarks on the price of explosives and their effect on mining in the Union of South Africa. Before quoting him we may mention that the De Beers group of mines, at Kimberley, in South Africa, is the greatest producer of diamonds, the output in 1913, the year before the War, being 2,293,000 carats, worth $30,400,000 from 8,695,000 loads (1600 lb. each). This company controls the Cape Explosive Works which in 1917 produced 437,158 cases of dynamite. He said:

Thanks to the Cape Explosives Works, which, as you know, are entirely owned by De Beers company, the mines of South Africa have been kept regularly supplied with dynamite, etc., since the commencement of the War, and at prices which I am justified in saying will bear favorable comparison with those charged at the different centres of consumption where our explosives do compete, and much more so where they are not allowed to compete. One may without hesitation say that were it not for the existence of our factory, mining operations in South Africa would today be seriously curtailed, an event that would be greatly detrimental, firstly, to the thousands of artisans and other workers employed in and affected by the mining industry; and, secondly, to the revenue of the State. I dread to think of the prices that would have been demanded from consumers of this indispensable mining requisite if they had been left to the tender mercy of those who controlled the production and distribution of explosives before the advent of our factory at Somerset West. Let me put before you a few interesting facts: Prior to 1899, the price paid in the Transvaal for blasting gelatine to Nobels (who had the monopoly) had reached as high as £5 7s. 6d. ($25.80) per case (50 lb.). When the Transvaal was subsequently proclaimed a British colony, the Nobel monopoly was cancelled, with the result that in 1901 the prices dropped to 87s.6d. ($21) per case, and in 1902, when our works were nearing completion and the shadow of the Somerset West factory was already hovering over the horizon of the then existing monopoly, it declined to 67s.6d. ($16.20) per case. As soon as the Cape Explosives factory entered the field in 1903, our price worked out at 58s.9d. ($14.10) per case, delivered in Johannesburg, and in subsequent years the prices were as follows: In 1906, 53s. ($12.72) per case; in 1907, 48s. ($11.52); in 1908, 46s. ($11.04); and in 1911, 45s.6d. ($10.92). At or about that figure the price remained until 1913, when it rose temporarily to 48s.9d. ($11.70), and then it gradually descended until in June 1916—nearly two years after the commencement of the War—it stood at 45s.9d. ($10.98). Since then the price has slightly risen, owing to the high cost of raw materials due to the War.

The price paid in Bulawayo [Rhodesia] had in 1901-'02 reached as high as 80s.3d. ($19.26) per case, but at the end of 1903, when the Cape Explosives Works came into competition, the figure dropped to 69s. ($16.56); and in 1907 it was 60s. ($14.40); in 1908-'10 it was 49s.3d. ($11.82); in 1911-'12, 47s.6d. ($11.40); in 1913, 50s.6d. ($12.12); and on June 30, 1916, the price was 47s.6d. ($11.40) per case. It has slightly risen of late for the same reason as applies to the increased prices in other markets.

At Kimberley, before De Beers manufactured its own dynamite, there were two classes of explosives used in the mines, which were supplied by the Trust, and the respective prices were 65s. ($15.60) and 57s.6d. ($13.80) per case. In 1903 De Beers manufactured their 40% 'ligdyn,' which was sold on delivery at 33s.6d. ($8.04) per case. The price gradually dropped until in June 1916 it stood at 28s. ($6.72) per case delivered.

From 1903-'07 the price charged at Melbourne, Australia, was 75s. ($18) per case, and during the latter year it fell to 70s. ($16.80), and continued at that level until the end of 1908. When our company came into the Australian market early in 1909, the price dropped to 54s.6d. ($13.08) per case delivered, and in June 1916 it had fallen further to 52s.3d. ($12.54).

At Broken Hill, New South Wales, in 1905, the price was 51s.6d. ($12.36) per case, rising to 67s.6d. ($16.20) in 1908; but on the entry of our company into competition in 1909, the price immediately dropped to 59s. ($14.16) per case, and on June 30, 1916, our price was 56s.9d. ($13.62) per case, delivered. John Darling, chairman of the Broken Hill Proprietary Co., in a speech to the shareholders of that company on February 25, 1910, said, with reference to the introduction of the Somerset West Works explosives into the Australian markets: 'It is computed that the saving to the mining companies in Australia from this competition amounts to no less than £125,000 ($600,000) per annum.'

In April 1917 the price of the Giant Powder Co. at San Francisco for blasting gelatine stood at 100s. ($24) per case, while our cost for the 10 months July 1916 to April 1917 was 42s.10d. ($10.28) per case, and our provisional price to the Johannesburg mining companies was 43s.6d. ($10.44) per case.

I wonder what the world would be paying for explosives today were it not for the competing influence of the De Beers Explosives Works. . . . Roughly speaking, the explosives used in South Africa for mining purposes are today half the price they were before we commenced the erection of our large works at Somerset West. Prices charged for explosives in Cornwall, England, are much in excess of those at our factory, notwithstanding the fact that wages are much higher in this country (Africa) and that we have to pay heavy freights on the raw materials. To show the contrast in the figures I will give you the following examples: In February last 50% gelignite was 60s. ($14.40) per case in Cornwall, and our price free on truck at Firgrove was 30s. ($7.20); 75% gelignite in Cornwall was 70s. ($16.80) per case, against 38s.3d. ($9.18) at our factory, while gelatine was 77s.6d. ($18.60) per case in Cornwall, compared with 43s.6d. ($10.44) at Somerset West.

Cyanidation at San Juancito, Honduras

During 1917 the New York & Honduras Rosario Mining Co. treated 125,900 tons of ore. This assayed 15.026 oz. of silver and 0.1165 oz. of gold per ton, equal to $9.84. The extraction of silver was 88.31%, and of gold 94%. The cost of treatment was $2.61 per ton. The 20 stamps weigh 1850 lb. each. The average time of treatment was as follows:

	Hours
Batteries to high agitation-vats (in weak solution)	4.0
In high agitation-vats (in strong solution)	40.2
High agitation-vats to filter-presses	12.5
Total period	56.7

Chemicals used were 2.463 lb. of sodium cyanide, 0.917 lb. of zinc-dust (on 18,650 tons), 0.306 lb. of aluminum-dust (on 107,250 tons), 1.912 lb. of soda-ash, 0.009 lb. of lead acetate, and 17.878 lb. of lime per ton.

The increasing cost and scarcity of cyanide made it

TREATMENT PLANT AT SAN JUANCITO, HONDURAS

imperative that a means be found whereby less of this chemical be used, at the same time not decreasing the extraction. The substitution of aluminum-dust for zinc-dust as a precipitant seemed to solve the difficulty, as it is well known that under certain conditions a good deal of cyanide is regenerated when aluminum is used. In 1916 laboratory experiments were under way, and although these did not prove entirely satisfactory, precipitation by aluminum-dust, in place of zinc-dust, was nevertheless definitely adopted on a working-scale in February 1917. In spite of some discouraging features at the outset, one of which at first affected extraction somewhat adversely, while another prevented a contemplated increase in the rate of milling, it is pleasing to state that aluminum precipitation has proved a most important economic success.

In comparing the cyanide consumption since the aluminum process was adopted with that of the year 1915, when zinc was used entirely, an average saving of 1.215 lb. per ton of ore is shown. As 107,250 tons of ore has been treated under the new process, 130,309 lb. of cyanide has therefore been conserved.

Using the latest cost of cyanide, aluminum, zinc, and soda-ash as a basis, there is a saving of 38 centavos (17.5 cents) per ton, and as the decrease of lime consumption from 29.7 lb. per ton in 1916 (when zinc-dust was used) to 17.9 lb. per ton in 1917, is almost entirely attributable to the adoption of aluminum precipitation, a further saving of 20 centavos (9.2 cents) per ton has been effected, which in all makes a total saving of 58 centavos (26.7 cents) per ton.

At the present time improvement in two directions presents itself in connection with the aluminum process. The first is a saving in aluminum-dust; the second the further prevention of incrustation by calcium aluminate in the mill-piping. Hopes of success in solving each of these problems are entertained, and they will have full attention during the current year.

Melting the precipitate into doré bullion continues to be the practice. Since aluminum precipitation was adopted more fluxing materials are necessary, but the bullion produced is consistently finer, therefore the extra cost for flux is somewhat offset. As precipitates by aluminum weigh considerably less than an equal volume produced by zinc, it is now even more advantageous to do the melting in Honduras instead of shipping the precipitate, in spite of increased cost in materials.

PROPERTIES OF ELECTROLYTIC COPPER. Previously published values for the modulus of elasticity having varied so much, tests were made by E. Melbourn ('Jour. Brit. Inst. Elec. Eng.') to determine it for stranded cables under actual working conditions. An experimental span of about 150 ft. was set up with specially reinforced terminal blocks. The wires used were 7 strand, 0.025 sq. in. total area; 7 strand, 0.05 sq. in.; 19 strand, 0.10 sq. in.; and 37 strand, 0.25 sq. in., bare copper cables. The tests were made under the same conditions, namely: 1. The points of suspension were leveled with a theodolite. 2. The span-lengths were pulled up to about 6 in. dip, just under one-half the breaking-stress and allowed to stand two hours. 3. The strand was then let out to about 12 in., about one-fifth the breaking-stress, and the dip, d_1, at the centre of the span, measured. 4. The span-length was then loaded with an extra length of the same size strand, and the new dip, d, measured. This was equivalent to loading the strand with its own weight of ice, distributed over its length. 5. The measurements were made in still air, and at the same temperature. 6. On removing the extra length of strand under (4), the original strand returned to dip d_1 under (3), thus showing no slipping and no strain beyond the limit of proportionality. Still's formula $(W_1/d_1) - (W/d) = 65(d_1^2 - d^2)\,MA/3^{14}$ was used. From the modulus, M, in millions of pounds per square inch was calculated for the different cables; $M = 20.11$ for the 7 strands, 0.025 sq. in cable; 19.85 for 7 strand, 0.05 sq. in. cable; 17.36 for the 19 strand, 0.10 sq. in. cable; and 15.46 for the 37 strand, 0.25 sq. in. cable. From these figures the value of M for a 61-strand conductor would be 14,000,000, and for the 91 strand conductor, 12,500,000. These tests confirm those made by W. B. Woodhouse for values under working conditions.

Concentrates

A METAL is an element that forms a base by combining with an hydroxyl group or groups.

DANGER SIGNALS should always be put in dangerous places, and be left there as long as the danger exists, but as soon as the danger is removed the sign must be removed.

COSTS of mining companies in South America are considerably affected by the rate of exchange. In 1917, the Chile Copper Co.'s labor charges were increased nearly one cent per pound of copper thereby.

RADIO-ACTIVE ORES accelerate the rate of discharge of electricity from a charged body, because the rays they give off ionize the atmosphere surrounding the charged body. Hence an electroscope can measure radio-activity.

QUICKSILVER contained in silver metallics of the Kerr Lake mine at Cobalt has averaged 1% per ton of silver, or 20 lb. from 2000 lb. This is recovered by a condenser-tube fixed to the air-tight cover on the crucible melting-furnace.

FLOTATION RESULTS at the Burro Mountain copper mines of Phelps-Dodge Corporation show that marked improvement is not to be expected by variations of reagents, but rather by prolonged or slower treatment. This ore contains 1.97% copper.

PURE NICKEL does not rust or oxidize; neither will the metal tarnish like silver or some of the alloys, such as german silver (copper, nickel, zinc). Nickel is practically immune from attacks by alkalies, and is largely resistant to the action of most acids.

BURRED AND DEFECTIVE HAND TOOLS are one of the most common causes of minor accidents. Foremen and men should see that such tools are removed from service, and put in good order. Burrs should be dressed off all hammers and steel, and only 'good order' tools should be used.

OIL IN SHALE is considered by some engineers not indigenous to the shale from which it can be distilled, but was formed elsewhere and then migrated to the shale, where it became adsorbed and inspissated, so that it cannot be extracted by solvents of petroleum, but must be obtained by destructive distillation.

WATER has been a great expense to the Old Dominion Co. at Globe, Arizona. As much as 11,500,000 gal. has been pumped in a day. In 1917 the maximum flow was 4,898,393 gal. Pumps installed have a capacity of 20,000,000 gal. daily. It was found in 1916 that below Pinal creek there was an area of exceedingly broken and porous ground near the mine, that probably let in water from the creek. During 1917, a total of 2015 ft. of holes was drilled in the creek-bed, and 23,000 tons of mill slime run into the ground through the holes. When the wet season commences the results of this grouting will be shown.

SEEMINGLY EMPTY GASOLINE CANS or tanks are probably more dangerous than those filled with gasoline. Usually the can is not entirely emptied, the remaining gasoline will vaporize, the vapor will mix with the air in the can, and the mixture may easily be explosive. When the can is being filled, this mixture is forced out by the gasoline and may explode if ignited by a flame or spark near the opening.

LITHIUM compounds find several important uses; for example, lithium hydroxide is a constituent of the electrolyte of the Edison storage-battery, and other lithium salts are used in pharmaceutical preparations. Metallic lithium, a silver-white soft metal, is the lightest of the alkali metals—so light that it will float on water. Lithium colors a flame deep red, and has been used in fireworks and signal-rockets, and is otherwise of military use.

THIS SIMPLE TEST FOR CASSITERITE, given by F. L. Hess, of the U. S. Geological Survey, should be useful in prospecting: Place a fragment of the mineral in dilute hydrochloric or sulphuric acid with granulated, shot, or sheet-zinc. The zinc and the acid rapidly evolve hydrogen, which takes the oxygen from the mineral, leaving a coating of tin on the fragment tested. Granulated zinc is the best to use, as its small particles can be made to touch the specimens at many points, thus bringing more of the hydrogen into contact with the molecules of tin-oxide. The reaction is

$$4H + SnO_2 = Sn + 2H_2O$$

The metallic coating has a dull gray, somewhat leaden appearance, but it may be made lustrous by rubbing with a soft cloth or with the hand. If the hand is used, the characteristic odor given off when tin is rubbed on the flesh may be noted.

TIME in mixing concrete in machines is usually guessed at by the man in charge. In addition to this, he has the following duties: observe the motive power in a general way, raise and lower the skip without striking careless workmen, supply the proper amount of water for the mixture, and, finally, operate the bucket in placing the concrete. In addition to all of these he is expected to guess to a few seconds the time concrete is in the dump. An automatic device, consisting of a small gear-wheel that is worked by the main gear on the machine, a train of small gears, and a gong, has been tried successfully. This batchmeter not only relieves the operator of guessing, but the man in charge knows by the bell that the materials have been sufficiently mixed. One of the most unusual features of this device is the effect produced by the ringing of the bell. It seems to affect the whole organization in that the men in front of the mixer speed-up to receive the coming batch; also the men behind the mixer are awakened to the fact that their material should be in the skip in the next few seconds, to prevent delay.

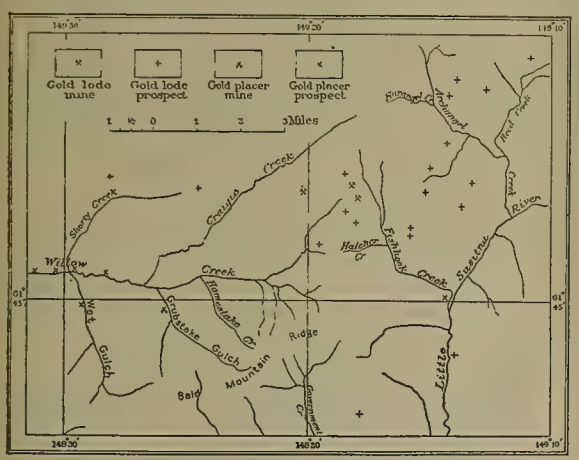
REVIEW OF MINING

ANCHORAGE, ALASKA

Railroad Construction.—Willow Creek Notes.

The $7,000,000 requested by the Alaskan Engineering Commission for the year's work for continuing the construction of the Government railroad was cut to $5,250,000 by the House Committee on Appropriations. One million dollars for development of Matanuska coal for the Navy has also passed the House. Both of the bills are awaiting confirmation by the Senate. Work on the Government railroad is progressing as rapidly as men can be obtained. Day and night shifts are working on the Turnagain Arm division. The Dredge 'Sperm' is digging a channel to the site of the proposed dock.

Doheny & Thompson of Montreal, operating the Gold



PART OF WILLOW CREEK DISTRICT, ALASKA, SHOWING SITUATION OF PROPERTIES (U. S. G. S.)

Bullion mine under the name of Willow Creek Mines, had a small crew doing development during the past winter, and began milling ore on May 29. A new penstock has been built—giving 14 ft. additional head—and a new turbine installed, which is expected to operate to better advantage under conditions of water scarcity than the former system, also to prolong the milling season, generally lasting 120 to 140 days from June 1. The mill is equipped with 12 stamps and 2 Wilfley tables, and has a capacity of 50 tons in 24 hours. A cone classifier divides the tailing into 70% sand and 30% slime. The former goes to tanks and the slime is impounded at present. The sand-leaching plant has a capacity of 45 tons per day; 35 tons coming from the mill and 10 tons from old material. This plant also treats concentrate from the Wilfleys. The company is to install a Dorr continuous-decantation plant to treat slime at an early date. The mine workings are at an altitude of 4500 ft., and the mill 3000 ft. An aerial tram one mile long conveys ore from mine to mill. A. T. Budd is manager and N. D. Bothwell superintendent. Seventy men will be employed.

William Martin, of Seattle, largely interested in the Willow Creek district, will operate the Mabel and Independence mines this year, in addition to the Alaska Free Gold.

The Talkeetna Mining Co.'s property, on Archangel creek, is under lease and bond to W. R. Hocking of Seattle, who is now on the ground with men.

The Willow Creek Development Co., Charles Herron, president; Judge David, treasurer; T. Bedell, secretary, will do development on the Isaacs group on Reid creek, which is under bond to the company.

L. R. Rinker, of Loveland, Colorado, representing people from that district in the New Mabel Mining, Milling & Power Co., is in the Willow Creek district. His company has a bond on the Arch group and will do development this summer.

The LeRoi Mines Co. has been organized to develop prospects on Archangel creek in the Willow Creek district. George Carrol is president; Ben Levin, treasurer; R. M. Courtnay, secretary; and J. R. Austin, general manager. The capital is $300,000, par value $1.

BRECKENRIDGE, COLORADO

Placer and Deep Mining Operations.

Dredging continues unabated in this district. No. 1 boat of the Tonopah Placers Co. and a boat of the Powder River Gold Dredging Co. are operating in the old channel of the Blue river, a little over two miles north of Breckenridge. The gold secured is generally round, the nuggets are scarcer than in the Swan river and French gulch. No. 2 boat of the former company is doing well on leased ground of the Farncomb Hill Gold Dredging Co. in the Swan valley. Its No. 3 boat and one of the French Gulch Dredging Co. are doing well in French gulch. The Tonopah Placers during the season of 1917 dug 3,351,821 cu. yd. of ground in the beds of three streams producing $451,743 at a cost of 7.6 cents per yard.

The Royal Tiger company is operating the old I. X. L. in Swan valley, under the management of T. A. Brown. A new mill, something out of the ordinary, provides for the sorting of lumps of high-grade ore before pulp reaches the jigs. The vein, 50 ft. between walls, carries lead and bismuth. If present methods prove satisfactory, a 300 or 400-ton plant will be erected.

Re-timbering of the Cleveland tunnel of the Mattie B. Mining Co. has been completed. It passed through an 80-ft. fault, and recovered the vein. The tunnel cut copper ore 300 ft. from the portal. Drifts show it to be 18 to 30 ft. thick. The ore carries gold, silver, and copper. J. A. Hazen is manager.

Paul Burdette is still working his lease on the vein that he followed from the Ella workings into ground owned by the Wellington Mines Co. and makes semi-monthly shipments of lead carbonate ore in carloads.

The 20-stamp amalgamating and concentrating mill of the Big Jesse property has for some time been operated satisfactorily on good ore. George F. Roth, of Rochester, New York, lately became manager.

Ray Meyers, William Sauers, and others are to drive a drift from the Puzzle Extension lode in Illinois gulch to cut the two veins of the Washington property, 200 ft. below the level of the present Washington workings.

The orebody of the Monte Cristo is of blanket type, and appears to be from 4 to 7 ft. thick, carrying gold, silver, iron, and zinc. The re-modeled mill of the Monte Cristo has been in commission for some time, handling ore of the Liberty Leasing & Milling Co., of which Frank Peabody is manager.

The Gold Bond Extension Co. is working claims on Mt. Guyot. The principal vein is 4 ft. wide, containing a 2-ft. pay-streak. The ore is said to be worth from $50 to $100 per ton in silver. Monthly shipments during the summer will be made from 50 to 75 tons.

Ellwood & Wiseland recently shipped a carload of good-grade silver-lead ore from the Pilot in the Montezuma district. One vein of the Pilot contains arsenic, some of which is in the form of long crystals.

The tunnel of Crown Point, one of the old Union Group on Mineral hill, has been put into good repair by G. Calvert Smith.

PLATTEVILLE, WISCONSIN

Zinc, Lead, and Pyrite Mining and Markets.

Mine operators in the first half of June were apprehensive over the possible shut-downs because of low prices for zinc ore, poor demand, and a rapidly increasing surplus of concentrate; but were greatly relieved in the second half by better prices. On high-grade refinery blende, used in sheet and plate mills, the allocated base price of $75 per ton, 60% metal, prevailed; but the quantity diverted to this branch of the spelter industry was comparatively light, less than 10 cars weekly. On second and inferior grades the range was $45 to $60 per ton, 60% assays, down to $42.50 to $50, with a rather indifferent demand for ore prevailing the better part of the month. Low grades were entirely undesirable in the first two weeks. Independent producers selling in the open market contented themselves with restricted output and storing in bin, until about mid-month the reserve in the field of all grades was in excess of 12,000 tons. It was this stock that inspired buyers with the belief that ore could be had in quantity at their own offers, but a rapid rise in the price of spelter changed the situation completely, and prices of concentrate moved with the gain in the price of the metal. Several mines in the field that had suspended production resumed work, and began recruiting working forces to their former strength, a rather difficult undertaking at present.

Lead producers had nothing to worry them. The month opened at $85 per ton, 80% metal content. Later in June offerings were as high as $97.50 on choice lead concentrate, and some lots in excess of 80% had been bid in at over $100 per ton. The reserve held at the beginning of the month, over 2000 tons, was considerably increased, fine weather enabling many miners to invade old diggings and shallow surface workings from which was culled fair-grade lead ore thrown upon the waste-piles many years ago. Producers holding in quantity were not tempted to sell much, even when top prices were offered. Producers were sanguine that the price would advance over $100 per ton. Most of the lead ore that reached rail was sold to the Federal Lead Co., which for years has employed a system of paying for it as soon as weights are certified. This method is liked by producers, and much competition in bidding for lead ore is through this procedure eliminated.

The demand for iron pyrite continues. The output is about 800 tons weekly, nearly all of which comes from the zinc-ore refineries in the field. A new sulphuric-acid plant is to be constructed at the National Zinc Ore Separating Works at Cuba City. It will be able to treat 200 tons of crude concentrate daily and make 100 tons of commercial acid daily. The acid department will be under the direction of W. N. Smith, of the Vinegar Hill Zinc mines, general manager of this company's producers in both the Missouri and Wisconsin fields.

Deliveries during June to local refineries and to smelters out of the field were 16,005 tons of blende, 715 tons of lead, and 1992 tons of pyrite.

COBALT AND PORCUPINE, ONTARIO

New Mining Districts.—Condition of Gold Mining.

Cobalt.—Some of the large Cobalt mining companies, which are looking for new prospects to develop, are investigating properties in the south-eastern portion of Bucke township, three miles north of Cobalt. This area may prove to be an important extension of the Cobalt field. A contact-zone occurring on the shore of Lake Temiskaming is stated to extend for several miles in a north-westerly direction through Bucke. It is characterized by considerable faulting, and some promising veins have been discovered. The Mining Corporation of Canada has taken an option on 80 acres in north Cobalt, and is said to be negotiating for other properties. Several other deals are pending. Good results from the re-opening of the old Green Meehan mine, which is now yielding high-grade ore, have helped to stimulate interest in this area.

The Kenabeck Consolidated Silver Mines, of which high expectations were entertained at the outset, has gone into liquidation. E. Champagne has been appointed liquidator.

The Trethewey company of Cobalt has decided to continue the shaft on the Castle property at Gowganda, being developed to the 350-ft. level.

Porcupine.—All expectations of an early resumption of ore treatment at the Dome mill have been abandoned, as the company is disposing of its milling supplies, chemicals, etc., valued at $300,000. This condition will apply until the return of more favorable economic conditions.

The Vipond-North Thompson is being closed indefinitely, and underground operations are being curtailed.

The Newray mill has been overhauled and is again in operation.

The Dome Lake has cut a third shoot on the 500-ft. level, showing 6 ft. of good ore. A winze will be sunk 100 ft. on this. The mill is extracting 90% of the gold.

At the Davidson the shaft will be deepened to 700 ft. A transmission-line is being constructed from South Porcupine to supply power, and a larger plant will be installed. David Sloan has been appointed manager.

Promising gold discoveries are reported to have been made in the Teddy Bear River district, and a number of prospectors have gone in. The Teddy Bear flows into Lake Abitibi, and is seven miles west of the Ontario-Quebec boundary. The formation is stated to be similar to that of the Lightning River district, of which it is presumably a continuation.

LEADVILLE, COLORADO

Two Mines Shut-Down Permanently

As mentioned in the Mining Summary of July 13, the shutting-down of the Leadville unit of the U. S. S. R. & E. Co. is a big loss to this district, as apart from the monthly payroll of $8000, great things were expected from the exploitation of the old workings.

All the known orebodies in the Tucson mine of the Iron Silver Mining Co. have been extracted, no new ones have been found, so it is to be closed. Salvage of underground equipment is now in progress. The Tucson was for years one of the most productive mines in the district, shipping zinc-lead sulphide ore. The Mikado shaft ground, acquired two years ago, is yielding 250 tons of zinc ore daily, but this output is to be increased.

Activity in the manganese properties continues.

THE MINING SUMMARY

ALASKA

Juneau.—Alaska Gold Mines in June milled 82,600 tons of $1.25 ore, recovering 83.31%. Tonnages since the beginning of the year are as follows:

Month	Tons	Value per ton
January	179,300	$0.903
February	140,305	0.934
March	150,093	1.114
April	125,435	1.148
May	101,200	1.114
June	82,600	1.250

For some reason shares recently jumped from $1.25 to $3.50, but have eased off to $2.50.

Kasaan.—The shaft at the Granby Consolidated's It mine has been sunk 275 ft., and stations are being cut at the 85, 170, and 255-ft. levels. Diamond-drilling has been started and each level will be prospected. From 225 to 255 ft. the shaft was all in ore, and looks promising.

Ketchikan.—A 100-ton mill, employing gravity and flotation methods of concentration, is working at the Saltchuck property of J. E. Chilberg of Seattle, 60 miles north of this place. The first shipment assayed 44% copper, 2 oz. gold, 14 oz. silver, also some platinum.

ARKANSAS

Batesville.—The Chanute Spelter Co. is re-opening a manganese mine near here, idle for 30 years. E. W. Buskett has a deposit assaying 45% Mn and 2½% Fe. A. Miser, of the U. S. Geological Survey, is completing an investigation of manganese in this State.

ARIZONA

All copper producers have advanced wages by 50c. per day, effective July 1. Men in the Miami district now get $5.65 per shift.

Ajo.—New Cornelia is to start at an early date excavating for a 500-ton experimental flotation plant to treat its sulphide ore. The machinery has been ordered. In June the output of copper was 2,821,676 lb. of cathodes, 935,807 lb. of cement metal, and 443,280 lb. in sulphide ore smelted, a total of 4,200,763 pounds.

Bisbee.—The Phelps-Dodge Corporation has made a change in its bonus system and started an arrangement whereby each man in its employ for one year shall receive an additional bonus for each year of service up to a maximum of $250, when no additional bonus will be paid. The main points are as follows: After July 1, 1918, every employee who has remained in the service of the company continuously for one year will receive a bonus of $100 upon completion of his year's service, and for each additional year of continuous service an additional $10 will be paid until the annual bonus amounts to $250, when no further increase will be made in the annual bonus. The bonus is in no way related to the wage-rate, or kind of work done. It is a flat bonus for continuous service and the same amount will be paid to every employee, regardless of his daily wage, monthly salary, or nationality. In order to receive the bonus employees must remain continuously with the company, but time lost on account of sickness or accident will not count against them after they return to work. They will be allowed to lay-off for a total of 30 days during any year's service period, provided written permission is obtained.

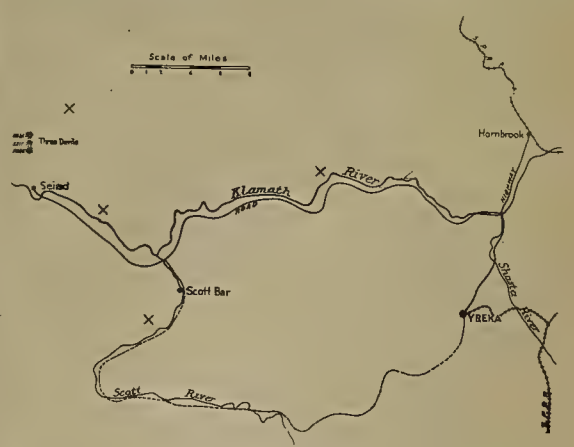
Jerome.—The United Verde Extension has blown-in its first furnace.

Johnson.—The Arizona United Mining Co., owner of the Republic and Mammoth mines, in Cochise county, states that it has terminated the lease made three years ago to the Goodrich Lockhart Co., operating as Cobriza Mines Development Corporation, and has resumed possession and operation of its properties. Heretofore operations conducted by lessees were limited to mining and shipping high-grade direct-smelting ore. The company will enlarge operations and, in addition to continuing the shipping of rich ore, proposes to develop lower grades. During the period of operations by lessees, shipments were made of 6500 tons per month of 5% copper ore.

CALIFORNIA

Carrville.—The Yukon Gold Co. has stopped its dredge on the Trinity river, and will dismantle it. About three years ago the boat was erected in Morrison gulch, near Carrville, at large expense. The ground was found to be unpayable, so the boat was moved three miles down the river. Here, large boulders have interfered with operations and made recovery of the gold difficult. The report of this company for 1917 makes little mention of any difficulties.

Yreka.—To assist in mining chrome in Siskiyou county, estimated by assistants of Albert Burch of the U. S. Bureau



PART OF SISKIYOU COUNTY, CALIFORNIA, SHOWING ROAD TO BE IMPROVED ALONG THE KLAMATH RIVER TO AID MINING OF CHROME. THE DOTTED ROAD WAS PROPOSED, BUT GRADES ARE HEAVY.

of Mines to be 30,000 tons, the Federal government has appropriated $5000 to $10,000 to aid in improving the road from the junction of Little Shasta river with the Klamath river, down the latter to Seiad about 50 miles. Siskiyou county is also to expend $10,000 on the road, producers will pay 4 cents per ton-mile for the chrome hauled over it, and as back-loading the auto-trucks will carry material to

be used in maintenance. From Little Shasta river to Hornbrook on the Southern Pacific, this is part of the State highway from Yreka, which is finished. The haul to Hornbrook is easier than to Yreka.

Copperopolis.—The Napoleon Mining Co., operating at Telegraph City, 7 miles west of here, has erected precipitating boxes, 450 ft. long, to recover copper from rich mine-water. The mine is 500 ft. deep, but is only unwatered to 200 ft. A new hoist has also been put in, also two Diesel engines to drive an Allis-Chalmers ball-mill, two concentrators, and an M. S. flotation unit, to dress 90 tons of ore daily. The new plant is expected to be ready by September. David Coughanour is superintendent of this mine, which has a past output of $1,200,000 in copper and gold.

Sacramento.—In the 'Press' of July 13 it was stated that in the dispute between William Hales and others and the Central Pacific Railway Co., and the Power Timber Co., assignee, the Land Office had decided that miners may file mineral claims to railroad lands in California found to contain chrome. The vital point in the decision was that the suit involved unpatented railroad lands. Locations cannot be made on patented railroad lands. This suit was started a year ago. The locations were the four claims called the Iowa Hill Chrome Ore Mines in Placer county. The defendant contended that the ore was an iron ore. A sample from all the claims averaged 45.38% Cr_2O_3 and 11.6% Fe. The chrome deposits were adjudged to be valuable, but the iron content was worthless.

San Francisco.—Reports filed with the State Mining Bureau during the week ended July 6 show five new wells starting to drill, making a total of 411 since the first of the year. There were 597 wells reported for the same period of 1917.

COLORADO

Climax.—According to H. L. Brown, consulting engineer for the Climax Molybdenum Co., the mill is to be enlarged from 500 to 1000-ton capacity. The present monthly output is 100 tons of MoS_2 concentrate, and some difficulty has been experienced in marketing it. To move miners from one level to another it is said that Otis elevators are to be used. This mine is worked through tunnels.

Cripple Creek.—The Portland company pays 2 cents per share on July 25.

Silverton.—The D. L. & W. Co., operating the Lackawanna, shipped 30 cars of ore to the Silver Lake mill during May and is steadily increasing its output.

The S. D. & G. Leasing Co., operating the Silver Lake Mines, is not shipping much ore at present.

The Ranchman Mines Co., holding a number of claims in this district, has been incorporated with a capital of $250,000. The officers are T. J. Downing, J. E. Burger, F. W. Sharp, S. R. Carney, and J. E. Burgess.

Indications for the present season's output of Silverton show that it may exceed that of 1917.

Telluride.—The Tomboy Gold Mines Co. paid a dividend of 12c. per share on June 28. This is equal to $37,200. In a circular issued from London on March 19, it was explained that the reduced profit was due to labor conditions, making it impossible to draw on the better ore in the higher levels of the mine. A circular of June 8, just to hand, states that the general manager, D. A. Herron, estimates general expenses for 1918 to be $74,000 per month, plus war taxes of $5000. Average monthly expenses in 1914, 1915, 1916, and 1917, were $50,000, $59,000, $64,000, and $69,000, respectively. To maintain the past monthly profit of $30,000 under present conditions would be forcing the mine to yield twice the profit earned in 1914, which cannot be done. Until conditions are better, the profit will therefore be $10,000 per month.

IDAHO

Mullan.—The Federal M. & S. Co. earned a profit of $134,874 in May. Losses were made in the first two months of the year.

Work at the National copper mine was not suspended as reported, but men are now stoping ore above the 1400-ft. level. A winze is to be sunk on ore below 1500 feet.

Wallace.—All mine employees in the Coeur d'Alene region —about 4000—have been granted a raise of 50c. per day, effective July 10. The wage will now be $5.25.

MONTANA

Butte.—All of the companies here advanced wages 50c. per day on July 4, making the average $5.75. A total of 21,725 people will benefit, receiving $2,750,000 per month. A wage increase conference was held in the office of C. F. Kelley, vice-president of the Anaconda company. Others attending were: W. A. Clark, representing the Clark interests; Charles Bocking, assistant manager of the Butte & Superior; Norman Braly, general manager of the North Butte; Oscar Rohn, general manager of the East Butte; William L. Creden, general manager of the Davis-Daly; Paul A. Gow, general manager of the Tuolumne; Al Frank, general manager of the Bullwhacker and Mines Operating Co., and a number of Anaconda officials.

The following is a table of the number of men employed by the companies operating in the Butte district, according to the 'Butte Miner':

Company	Men
Anaconda:	
Mines at Butte	10,200
Office at Butte	500
Washoe works at Anaconda, including office force of 150, and Southern Cross mine	3,600
Works at Great Falls, including office force of 50	1,850
Total Anaconda	16,150
Butte & Superior	1,600
North Butte	1,400
East Butte	950
W. A. Clark interests:	
Elm Orlu mine	500
Timber Butte mill	250
Ancient mine	20
Travona mine	30
Moulton mine	20
Butte Reduction tailing	10
Total Clark	850
Davis-Daly	400
Tuolumne	65
Butte & Ramsdell	40
Butte-Bullwhacker	35
Butte-Duluth Mines Operating Co	30
Butte-Detroit Copper & Zinc	15
Great Butte	10
Office men from all mining companies, excepting Anaconda	200
Total number Butte, Anaconda, and Great Falls employees	21,725
Total Butte (exclusive of lessees)	16,275
Total Anaconda	3,600
Total Great Falls	1,850

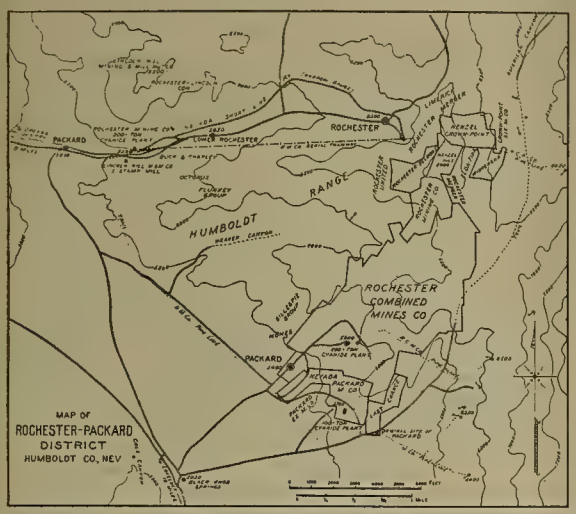
Mr. Kelley stated that the advance in copper to 26c. per pound serves only to give miners and other employees of the companies increased wages, and to enable the mining interests to meet the additional freight rate, which, in the case of the Anaconda company alone means an extra expense of $3,000,000 per year. Therefore one cent of the 2½c. higher price for copper goes to the railroads, and another cent to the increase of wages. The present wage contracts with all organized crafts will continue until July 1919. This increase is voluntary and does not abrogate these contracts. When the price of copper was fixed by the Government at 23½c., a stipulation was entered into with the Government that wages would not be reduced. As the then current price was about 26½c. this fixed the wage scale at 25c. per day above the contract schedule. The increase in wages now given establishes a scale that under the contracts with employees would only prevail when copper sold

between 29 and 31c., and increases the differential to 50c. per day above the contract schedule. The net result of the increased price, therefore, so far as the Butte district is concerned, is to distribute the bulk of it at once to the railroads and employees. Notwithstanding this fact, all of the operators expressed themselves as willing to meet the situation, and are pleased that the Government has enabled them to provide for the increased freight charges and to make a substantial increase in the wage-scale.

Phillipsburg.—Timbering in the shaft of the Jackknife manganese mine collapsed at a depth of 60 ft. on July 9, entombing seven miners under 40 tons of debris. Seventy men formed a rescue-corps and released the men late the next day. Food and water was given them through pipes.

NEVADA

Rochester.—The Nevada Packard Mines Co. has issued its report for the year ended June 1, 1918. The general superintendent is H. G. Thomson; mine superintendent, C. L. Holmlin; assayer and chemist, Waterfield Painter; and accountant, R. E. Adams. Earnings totaled $235,910, of



which $48,373 was profit. Current assets amount to $49,272, and liabilities $24,188. Development covered 2659 ft. This resulted in opening three important orebodies. A shaft is being sunk in the sheared zone along the contact-fault. This has cost $31 per foot. At 96 ft. a 4-ft. formation of sericite-schist was cut, assaying $4 per ton. The opening of a large lens of residual primary ore, the first sulphide ore in the property, was an important development. No estimates of reserves is possible, owing to the peculiarity of the ore. The mill treated 31,390 tons of $8.63 ore, extracting 88.5%. This yielded 250,387 oz. of silver and 357 oz. of gold. Mining cost $1.342; milling, $2.029; development, $1.521; and marketing bullion 11.1 cents, a total of $5.003 per ton. In 1916-'17 extraction was 86.8%, yielding 339,062 oz. of silver and 617 oz. of gold, and total costs $5.42 per ton. Merrillite was substituted for Japanese zinc-dust for precipitation, ending all troubles in that department. Cyanide on hand amounts to 19 tons, equal to 15 months' supply. The report for May 1918 shows an extraction of 91.5%, the highest since October 1916. All costs were 5 cents per ton lower than in April.

The Rochester Combined Mines Co.'s 300-ton mill is ready to start. This was designed by K. Freitag. There is said to be 200,000 tons of $12 silver-gold ore in reserve.

Round Mountain.—With a population of only 200, and 63 miles from rail, this place has subscribed $24.94 per head to the War Savings Stamps drive. To the Three Liberty Loans they subscribed $92,900, and to the Red Cross $1238. Altogether the per capita subscriptions to the War is $496.54. The Round Mountain Mining Co. is the principal operator here.

Tonopah.—Miners in the Victor shaft of the Tonopah Extension downed tools on July 9, demanding $7 per shift instead of $6, on account of their special skill. The company refuses to acquiesce, considering the demand as unfair.

OKLAHOMA

Douthat.—A 500-ton (in 10 hours) plant is being erected by J. J. McLellan and Ray Munson to dress tailing at one of the Admiralty Zinc Co.'s dumps. Assays show up to 5% zinc and lead. Equipment includes four sets of rolls, two rougher-jigs, one chat rougher or sand jig, one 7-cell cleaner-jig, 10 sludge-tables, and a flotation plant.

Picher.—Production of the mines last week was 3386 tons of blende and 595 tons of lead, worth $264,297.

A 250-ton mill is being erected for the Miami Wonder company. Rich ore has been opened at a depth of 208 ft. A. V. Ellis is superintendent.

The Jefferson Mining Co. has purchased machinery for a 300-ton mill to be erected near here. At a depth of 230 ft. there is a 12-ft. face of rich ore. A. B. Clark of St. Louis is president.

OREGON

Jacksonville.—The Blue Ledge, Copper King, and several properties in the Blue Ledge district are producing copper ore running over 12%. The wagon haul to Jacksonville costs $10 per ton. The yield this season from the district is expected to be considerable. It is reported that flotation plants will be erected at several of these properties.

UTAH

Dividends paid by Utah companies in the first half of 1918 totaled $9,306,570, compared with $15,242,845 in this period of 1917. The list is as follows:

	Per share	Total		Per share	Total
Bingham Mines	$1.50	$143,000	Ontario	$0.50	$75,000
Chief Con.	0.20	176,840	Pacific	0.01	4,000
Daly	0.20	30,000	Silver King Con.	0.10	70,000
Dragon Con.	0.02	37,500	Tintic Standard	0.09	105,730
Eagle & Blue Bell	0.20	180,000	Utah Con.	0.50	150,000
Grand Central	0.05	30,000	Utah Copper	5.00	8,122,500
Iron Blossom	0.02½	25,000	Western Utah	0.07½	37,000
Judge	0.25	120,000			

Bingham.—The Utah Copper Co. has raised the wages of 4500 men 50c. per day, effective July 1.

Garfield.—The A. S. & R. Co. has raised wages at this and its Murray smelter 50c. per shift; 2500 men benefit thereby.

Salt Lake City.—Ore producers and smelters in this State may quarrel over the increased rates and penalties being or to be levied by the smelters. A Federal mediator may be asked to investigate.

Tintic.—This district produced 200,000 tons of ore, worth $6,000,000, during the first half of 1918. In the same period of 1917 the output was about 240,000 tons. There are 40 mines shipping at present, led by the Dragon, Chief, Iron Blossom, Eagle & Blue Bell, Tintic Standard, Centennial, Grand Central, Mammoth, Colorado, Gemini, Gold Chain, and Victoria.

The Chief Consolidated company recently acquired 125 acres of land, formerly embraced by the North Godiva property. For this, $50,000 was paid. The Chief now owns about 859 miles in this district. Another large working shaft is to be sunk on the Crusader claim, a half-mile east of the present main shaft. It will be sunk to 2000 ft., and will be 17 ft. 4 in. by 6 ft. 2 in., with three compartments. Walter Fitch, Inc., will do this work. A hoist from one of

the other shafts will be used to 600 ft., after which a large one, on order, will be used.

The Chief Consolidated M. Co. almost finished putting in its electric pumps of 2000-g.p.m. capacity. Water from the lower levels will be raised to 1800 ft., then to 1200 ft., 600 ft., and the surface. The water-column is 8 in. diameter. Some of the water is to be used for fire protection.

CANADA

British Columbia

Trail.—An increase of wages has been demanded by employees of the Consolidated M. & S. Co. at several of its mines. In most instances the miners have accepted the company's offer of substituting the Rossland mines scale in the lead mines, which means an increase of approximately 15c. per day. Some, however, have refused this proposal. At the Sullivan mine, at Kimberley, an increase of 50c. was asked, which would give muckers $4.15 and miners $4.65 per day.

Three Forks.—During its past financial year the Rambler-Cariboo Mines received $78,785 from sales of lead and zinc ore and concentrate. A dividend absorbed $17,500. The balance is $20,832, about $1000 less than the previous one. There was mined 9500 tons, yielding 580,990 lb. of lead, 163,576 lb. of zinc, and 78,529 oz. of silver. The superintendent, W. A. Cameron, is hopeful about the mine, which has sufficient ore for two years' operation of the mill.

Ontario

Cobalt.—Silver output of the Kerr Lake mine in May was 268,213 oz., a record. There are 55 men employed.

Porcupine.—The Schumacher gold mine is to be closed until conditions are more favorable. Labor is scarce and supplies not only high in price, but some are most difficult to obtain.

The Teck-Hughes Gold Mines company has decided to close its property until conditions improve. The directors fully considered 'selective mining,' that is, extracting and milling the best ore, but after consulting expert advice they concluded that this would not be in the best interests of the company. Cash resources are small and not sufficient to carry on development for many weeks.

Port Colborne.—The International Nickel Co.'s new refinery here commenced operations last week.

Yukon

Dawson.—Hydraulicking on Last Chance creek started on about May 17. The Yukon Gold Co.'s plants on Bonanza were expected to commence soon after.

MEXICO

Chihuahua

Santa Eulalia.—The Buena Tierra Mining Co. has issued its reports for 1917. Political conditions in this State made it impossible to operate during the period, but as the A. S. & R. Co. was to re-start its smelter at Chihuahua in April of 1918, the management prepared to re-open the mine. Ore-reserves remain at 281,500 tons of lead ore, and the physical condition of workings and plant is good. Expenses in Mexico last year totaled $16,721. A. C. Brinker is general manager, and R. M. Raymond consulting engineer.

Applications for fellowships in the College of Mines, Seattle, University of Washington, and the Pacific Northwest Experiment Station, U. S. Bureau of Mines, will be received during the summer, the time for filing having been extended in order to meet the changes in personal plans incident to war service. Each fellowship has a value of $60 per month. Holders become candidates for the degree of master of science in mining engineering or metallurgy. Graduates in science as well as technology may apply.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

J. M. Callow is at Ray, Arizona.

C. O. Lindberg, of Los Angeles, is here.

John A. Rice is at Bully Hill, California.

Albert Burch has gone to Butte, Montana.

Gerard Lovell has arrived in London from Australia.

B. H. Dosenbach, of Butte, has been here on a short visit.

Frederick Bradshaw, of Tonopah, spent a few days in San Francisco.

J. M. Manson, of the Western Ore Purchasing Co., Hazen, Nevada, is here.

L. F. S. Holland has returned to Los Angeles from Boulder, Colorado.

Richard Snell has returned from the Butters Divisadero mines in Costa Rica.

James S. Wroth has been appointed First Lieutenant in the Engineer Officers Reserve.

D. H. Angus has resigned as manager of the Tough-Oakes mine at Kirkland Lake, Ontario.

Henry J. Russell, of Denver, president of the U. S. Rare Minerals Co., was here last week.

A. R. Globe, for several years assistant manager of the Hollinger at Porcupine, has resigned.

C. M. Eye, of Baguio, Philippine Islands, has been to Tientsin, Peking, and Tsingtau, China.

Chauncey L. Berrien, formerly at Anaconda, has been promoted to Major in the Aviation Service.

D. A. Mutch has been appointed manager of the Coniagas company's Ankerite mine at Cobalt, Ontario.

F. W. Bradley is making his periodical visit of inspection to the Treadwell and Juneau mines in Alaska.

H. Hardy Smith, recently at the Suan mine, in Korea, is now with the Huchang Mining Co., in the same region.

Robert E. Tally, mine superintendent for the United Verde Copper Co., at Jerome, Arizona, is at the St. Francis hotel.

Francis C. Lincoln, professor of mining and metallurgy in the University of Nevada, is now at Long Beach, California.

L. J. Mayreis has resigned the position of assistant resident manager of the Burma Mines Ltd. He left for New York in June.

Byron E. Janes, graduate mining engineer from the University of California, was killed at the El Tigre mine, Sonora, Mexico, on July 10.

D. C. Livingstone, representing the Idaho School of Mines, is on the north fork of the Coeur d'Alene river making an investigation of rare metals.

Seeley W. Mudd has been promoted to Colonel in the Engineer Officers Reserve Corps. He is on the New Hampshire coast convalescing from a recent illness.

Theodore Pilger, formerly with the Butte & Superior Mining Co. as mining engineer and geologist, has established an office as consulting engineer at Archangel, Alaska.

Elder Nance has just returned from the Orsk goldfield in Siberia. Conditions there have not been affected much by the War, save that labor is scarce and money transactions are difficult.

G. A. Roush, assistant professor of metallurgy in Lehigh University, and editor of 'The Mineral Industry,' has been appointed Supervisor of Training for the Inspection Division of the Ordnance Department.

THE METAL MARKET

METAL PRICES

San Francisco, July 16

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.30
Lead, pig, cents per pound	8.30— 9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

ORE PRICES

July 16

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Magnesite, crude, California, per ton (nominal price)	$7.00—$8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 54%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.25
Pyrite, per unit of sulphur, cents	28
Tungsten, 60% WO_3, California, per unit	$20—$24

Aluminum and bauxite in 1917 has just been issued by the U. S. Geological Survey. In the chapter is a list of consumers of the ore bauxite.

'Chromite,' a 30-page pamphlet by Albert Burch and S. H. Dolbear, is now ready, and may be secured free upon request.

The restriction on the import of graphite has been extended by the War Trade Board, effective for all 1918. Investigation shows that stocks and domestic production will suffice for requirements well into 1919.

The War Trade Board has amended the restriction on the importation of manganese to permit its importation, under the back-haul proviso, permitting its importation when shipped as return cargo from Europe and the Mediterranean coast of Africa, and when shipped from convenient ports where loading can be done without delay. Importations of manganese ore from the Far East have, by another ruling, been prohibited as to ocean shipments made on and after July 20, 1918; and, to make this ruling effective, all outside licenses for the importation of manganese from those countries have been revoked as to ocean shipment on and after July 20. Adequate supplies can be obtained, it has been found, from sources nearby, entailing far less strain upon present shipping resources.

EASTERN METAL MARKET

(By wire from New York)

July 16.—Copper is quiet. Lead is scarce and strong. Spelter is dull, though steady.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.30c., respectively, until August 15. Quotations in cents per pound are as under:

Date		Average week ending	
July	10	June	4
"	11	"	11
"	12	"	18
"	13	"	25
"	14 Sunday	July	2
"	15	"	9
"	16	"	16

	26.00	23.50
	26.00	23.50
	26.00	23.50
	26.00	23.50
	26.00	26.00
	26.00	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	....
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	....
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

Refined copper output of the United States for the first half of 1918 totals 1,220,000,000 lb., compared with 1,270,000,000 lb. in this period of 1917.

Copper production from some of the mines in June was as under:

Mine	Pounds	Mine	Pounds
Anaconda	25,800,000	Kennecott	4,044,000
Arizona	3,700,000	Miami	4,692,000
Calumet & Arizona	4,232,000	Nevada	7,250,000
Chino	6,706,000	Old Dominion	3,368,000
East Butte	1,999,000	New Cornelia	4,212,000
Braden	8,292,000	Ray	7,737,000
Greene-Cananea	4,100,000	Shannon	672,000
Inspiration	10,300,000	Shattuck	805,000
Iron Cap	850,000	Utah	18,500,000

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange.

Date		New York, cents	London, pence
July	10	99.62	48.81
"	11	99.62	48.81
"	12	99.62	48.81
"	13	99.62	48.81
"	14 Sunday		
"	15	99.62	48.81
"	16	99.62	48.81

Average week ending	
June 4	99.50
" 11	99.50
" 18	99.50
" 25	99.50
July 2	99.50
" 9	99.62
" 16	99.62

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	....
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	....
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	....
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Silver dollars representing $64,000,000 have been melted and silver certificates of $58,000,000 destroyed, to the first week in July.

A conference of all assayers in charge of the United States Assay Offices will be held at Carson, Nevada, in September, to discuss the provisions of the Silver Purchase bill, according to announcement made by Raymond T. Baker, director of the Mints. He says that there are many points to be considered under the Bill, and it is necessary to establish uniform rules for carrying out its provisions in all parts of the country; hence the conference. Mr. Baker will preside at the meeting and a number of other important questions in connection with the handling of the country's silver will be discussed.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 7.90c. per lb., New York, plus the extra freight.

Date		Average week ending	
July	10	June	4
"	11	"	11
"	12	"	18
"	13	"	25
"	14 Sunday	July	2
"	15	"	9
"	16	"	16

	8.05	7.16
	8.05	7.31
	8.05	7.61
	8.05	7.82
		7.90
	8.05	7.99
	8.05	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	....
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	....
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
July	10	June	4
"	11	"	11
"	12	"	18
"	13	"	25
"	14 Sunday	July	2
"	15	"	9
"	16	"	16

	8.85	7.50
	8.85	7.56
	8.75	7.70
	8.75	8.18
		8.78
	8.75	8.85
	8.75	8.78

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	....
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	....
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	13.85	9.63	7.92	Dec.	11.26	7.84	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds:

Date			
June	18	110.00	July 2 120.00
"	25	110.00	" 9 120.00
			" 16 120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	....
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	....
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	....
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	....
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	...

Eastern Metal Market

New York, July 10.

None of the markets is particularly active; all are fairly strong.

The 2½c. advance in the price of copper gives general satisfaction.

Tin is very quiet and without feature.

Lead is strong and inactive with the New York price advanced 15 points.

Zinc is quite inactive again but firm in price.

Antimony is unchanged and dull.

Disagreement on all the products considered was the outcome of the conference in Washington, July 3, between steel-makers and a special price-fixing committee. The makers of rails were at odds as between $57 and $60, the former satisfactory to the large interests. The Government proposed a much lower price. A meeting of steel-makers alone in New York on July 15 will attempt an agreement. The steel industry as a whole continues to make an unexpectedly good response to the call for war steel, aided particularly by cool weather. There are also indications of a better morale among the workers at iron and steel plants, stimulated by the zeal of the ship-workers. The large new locomotive plant at Chicago for the Baldwin Locomotive Works has taken shape in the inquiry before fabricators for 10,000 tons of material.

COPPER

As already indicated, in a late addition to the report of last week, the Government maximum price of copper was advanced 2½c. per lb. to 26c., as a result of the Washington meeting on July 2. It is now stated that this was to become effective on that day and to continue until August 15. The President is understood to have promulgated the new schedule officially. Not only was the increase a surprise, coming as suddenly as it did, but the extent of it was more than had been expected, no more than 25c. having been spoken of generally. The fact that the matter came up so suddenly and that it was moved forward for consideration from August 7 to July 2, leads to the conclusion that the Government had facts before it warranting the decision made. What these actually were, and what went on behind the scenes, is not publicly known. A representative of a large producer and seller told your correspondent today in substance what follows: Probably the new freight rates precipitated the matter, adding as they do to the cost of producing copper in many ways. Besides this, since the 23.50c. price was fixed last September, there have been advances in wages by many companies, and more are to come. The question of a proper or an increased recompense to refiners because of higher costs was another factor. The new increase will probably be absorbed largely by the higher costs so that low-cost companies will really be no better off than when 23.50c. price and lower freights prevailed. The possibility was mentioned that the new level would ensure the small producer a fair profit so as to keep them operating and thus make sure their needed output of about 100,000,000 lb. per year. That the present production is not as large as may be required, since the demand and consumption are increasing rather than otherwise, may have been a factor also in the deliberation. There is talk of a 27c. price after August 15, and it is stated that there is to be a meeting on August 7 to consider the basis to be established after August 15. The jobbing price is now 27.30c. per lb. in 5-ton lots or less, or 5% over the car-load price. It is almost self-evident that a much better feeling prevails in the industry. There is a good deal of confusion as to just how the new price affects copper already sold, but no definite understanding has been heard.

TIN

Practically no business has been done in the last week, and the market is quite bare of news or developments. Occasional lots, for future shipment from the Far East, have been sold, but they have been in small quantity and of no particular significance market-wise. They went at about 86 to 86.50c. per lb. There is nothing more heard about price-fixing, and there is no news as to supplies of the metal. There have been more arrivals of Banca tin at Pacific ports. Buyers are not endeavoring to purchase, knowing that there is little use in pushing matters. Arrivals at Atlantic ports up to July 8 inclusive had been 445 tons, with 1325 tons reported as having come in at Pacific ports. There is no estimate published as to the quantity afloat. The London market has advanced lately, and is now at £345 per ton for spot Straits as against £332 10s. a week ago.

LEAD

The new freight rates continue to cause confusion and changes in the market. Due to an adjustment on account of this, the lead producers have advanced the New York price to 8.05c., or 15 points above that of last week, with no change in the St. Louis price, which still stands at 7.75c. per lb. In this connection it is interesting to note that before the 25% increase in freight rates was authorized, the rate from St. Louis to New York was 19½c. per 100 lb. It is now 35c., with that from Omaha 27c. per 100 lb. The new New York price is therefore an average between these, or 30 points above the St. Louis price as a base. As to the market in general, it is the same old story—very quiet but very firm. There is undoubtedly a scarcity and producers are well sold up. Everybody is trying to prevent the market going to premiums by keeping it at quoted prices, so as to forestall Government-fixed levels.

ZINC

The market has become dead and devoid of interest after the late advance and the fairly large buying, especially by the Government. There has not been enough buying to really test the market. It may be quoted nominally at 8.85c., New York, or 8.60c. per lb., St. Louis, for prime Western for July or early delivery, with a slight premium for August and September. One large dealer quotes 8.55 to 8.62½c., St. Louis, for all of the third quarter, but reports no business. There is very little desire to buy or sell.

Grade A zinc is fixed at a maximum price of 12c. per lb. Sheet-zinc is regulated at a 15c. per lb. maximum with plate-zinc at 14c. per pound.

ANTIMONY

The market is quiet at 13 to 13.25c., New York, duty paid, for prompt and early delivery. There have been a few sales of 25-ton and smaller lots.

ALUMINUM

Government maximum prices continue for No. 1 virgin metal, 98 to 99% pure and for scrap, at 33c. per lb. for lots of 50 tons and over, at 33.10c. per lb. for 15 to 50-ton lots and at 33.20c. per lb. for lots of 1 to 15 tons.

MOLYBDENUM

The market is nominal at $1.25 per lb. of MoS_2 in 90% concentrate. It is stated that most of the Canadian molybdenite has been contracted for shipment abroad.

Mining Decisions

"Mineral" Defined Judicially

The term "mineral," when employed in conveyancing, is understood to include every inorganic substance which can be extracted from the earth for profit, whether it be solid, as stone, fire-clay, the various metals and coal, or liquid, as for example salt and other mineral waters and petroleum oil, or gaseous, unless there are words qualifying or limiting its meaning, or unless from the deed, read and construed as a whole, it appears that the intention was to give the word a more limited application.

Horse Creek Land & Mining Co. v. Midkiff (West Virginia), 95 South-Eastern, 26.

Coal Lands—Disqualified Holder May Transfer

One disqualified from holding title to coal lands could receive a title from the lawful owner thereof and transfer it to another who is legally qualified to hold it—in other words, could act as an intermediary for conveyances.

Ketchum Coal Co. v. Pleasant Valley Coal Co. (Utah), 168 Pacific, 86.

Oil and Gas Lease—Rights of Lessee Prior to Discovery

The lessor under an oil and gas lease is the only person who can take advantage of a provision in a lease providing for a forfeiture thereof for failure of lessees to comply with its terms. While the lessees acquire no vested estate in the premises prior to the discovery of oil or gas, yet they have the right to the possession of the land to the extent reasonably necessary to perform the obligations imposed upon them by the terms of the lease.

Brennan v. Hunter (Oklahoma), 172 Pacific, 49. April 9, 1918.

Coal Lands—Excessive Entries—Cancellation

In determining the validity of patents to coal lands, where it appeared that the entries were all made in pursuance of a scheme by an association of persons to obtain more land than allowed by law, the validity of any one or more of the several patents cannot be determined apart from the general scheme.

United States v. Kirk (Colorado), 248 Federal, 30.

Oil Lease—"Net Proceeds" Defined

Where an oil lease indicated that net profits were to be determined by deducting from the gross income only the royalty and operating expenses as distinguished from capital expenses, the words "net proceeds," as used in a modifying clause, providing that after the first four years at least half of a certain 15% of the net proceeds derived from the business should be paid to the plaintiff, meant net profits as above defined.

Nathan v. Porter (California), 172 Pacific, 170.

Oil and Gas Lease—Royalties—Forfeiture Waived

Where an oil and gas lease provided that royalties should be deposited to the credit of the lessor in a specified bank, the lessor constitutes the bank as his agent and if the bank accepts the lessees check for royalties several days after they are due under the lease, the lessor is bound by the acceptance and cannot forfeit the lease for non-payment within the stipulated time.

Beatty Oil & Gas Co. v. Blanton (Kentucky), 245 Federal 979.

Book Reviews

Accounting: Theory and Practice. A first-year text by R. B. Kester. Pp. 607, index. The Ronald Press Co., New York, 1918. For sale by 'Mining and Scientific Press.' Price, $2.50.

Looking at this subject from the standpoint of a mining company, we would say that this book will be found useful. During the course of a year we study and abstract from the balance-sheets of several hundred companies, whose accounting is based on the fundamentals discussed in the new work. The author says that this is an effort to supply a field rather barren of text-books for students of first-year accounting. Most students entering college do not have a knowledge of bookkeeping, while in some schools a knowledge of such is a prerequisite to entrance on the study of accounting. Between bookkeeping and accounting there seems to be no difference; it means the same thing. We consider that this volume is more than a first-year text, that is, it will do admirably for such a purpose, also for those experienced in the profession of accountancy.

A Handbook of Briquetting. By G. Franke. Translated by Fred. C. A. H. Lantsberry. Pp. 631, 9 plates, 225 ill., index. J. B. Lippincott Co., Philadelphia, 1917. For sale by 'Mining and Scientific Press.' Price, $5.

This book is Vol. I of a handbook originally written by Professor Franke of the Bergakadamie of Berlin. The work is intended not only as a text for instruction but as a practical guide for actual briquetting of coals and other fuels. The second volume will follow shortly and it is complete in itself, and either volume will be sold separately. It is the most exhaustive treatise on the subject probably to be found in the language, and will be of great value to engineers engaged in conservation problems, which are becoming more and more urgent. The historical account is interesting, but the larger value lies in chapters dealing with crushing, mixing, warming, drying, kneading, and heating coals, together with the binding materials used in briquetting, followed by an elaborate discussion of all the forms of presses in common use before the War. A large number of briquetting factories are described in detail, aided by working plans. The estimates of cost have only a relative value, but the comparison of economies obtained will apply, with altered figures, at the present time. The application of briquettes both for domestic use and industrial operations is discussed in great detail. The treatise on briquetting of coal is followed by chapters on briquetting of waste coke, waste brown coal, peat, sawdust, waste wood, and other organic materials. A brief discussion is also given to briquetting as applied to inorganic non-metallic materials, and the briquetting of salts. The book should attract a great deal of attention from engineers at the present time.

Fuel Economy in the Operation of Hand-Fired Power-Plants. Circular No. 7 of the University of Illinois Engineering Experiment Station. Urbana, April 1918.

There are two possible results of the probable fuel shortage next winter; either certain industries must close down or more work must be done with the coal available. This 90-page booklet, printed in four colors, shows that the average small power-plant can save 15% of its fuel by the exercise of greater care in equipment and operation. This means a saving of 12 or 13 million tons per annum if applied throughout the country. Important considerations are the coal, principles of firing, boilers and stacks, feed-water, steam piping, and record of operations.

Company Reports

PHELPS-DODGE CORPORATION

Properties: mines and works at Bisbee, Douglas, Morenci, Prescott, and Tombstone, Arizona; at Dawson and Tyrone, New Mexico; and at Nacozari, Sonora, Mexico.

Operating Officials: at Copper Queen Branch: G. H. Dowell, manager; Gerald Sherman, superintendent of mines; and H. H. Stout, superintendent of reduction works. At Morenci Branch (Detroit): M. H. McLean, manager; V. P. Hastings, smelter superintendent. At Burro Mountain Branch: E. M. Sawyer, manager. At Copper Basin Branch: A. B. Peach, acting superintendent. At Stag Cañon Branch: T. H. O'Brien, manager; J. B. Morrow, superintendent of coke works. At Moctezuma Copper Co.: J. S. Williams Jr., general manager. At Bunker Hill Mines Co.: E. Grebe, superintendent. At Phelps-Dodge Mercantile Co. (Bisbee): W. H. Brophy, general manager; W. A. Meyer, acting.

Financial Statement: sales of copper, lead, silver, gold, coal, coke, and merchandise totaled $61,161,459. Investments, etc., yielded $1,100,727. The total was $62,262,186. Operations cost $32,053,619; taxes, $5,857,595; depreciation and general, $1,894,065. The profit was $22,456,906, plus $15,687,126 brought forward from 1916, making $38,143,032 available. After paying dividends there was a balance of $27,343,032.

Dividends: four of $2.50, and extras of $14, amounted to $10,800,000. The total now (May 1918) is over $70,000,000.

Production: labor troubles curtailed operations at Bisbee and Morenci, while there was a general shortage of men. The output from all departments was 153,974,692 lb. copper, 8,136,356 lb. lead, 1,524,632 oz. silver, and 24,423 oz. gold. Including metal from toll operations, there was sold 274,994,140 lb. of 'C * Q' electrolytic and 15,528,429 lb. of P. D. ingot copper. The price fluctuated between 33¾ and 23½c. per pound.

Copper Queen Branch

Development: work was restricted by labor conditions, and covered only 58,518 ft., against 80,853 ft. in 1916, in the Limestone mines. The most important result was that in the orebody in the south-west. A system of fire-doors and sprinklers was put in, also the forced ventilation plant was completed. Ore production included 740,090 tons of copper by company operations and 35,986 tons by lessees, 15,476 tons of lead by company and 2571 tons by lessees, and 2379 tons of manganese. Lead ore was sent to El Paso.

At Sacramento Hill there was 290,771 cu. yd. of overburden removed. In the West deposit is 3,407,148 yd., to mine which must be moved 10,383,997 yd. of waste. A 3000-ton mill is to be erected to handle this ore. There were 2264 men employed at the mines.

Smelter: the works at Douglas received from all sources 1,276,817 tons of charge, which yielded 191,581,131 lb. copper, 2,042,263 oz. silver, and 32,331 oz. gold. Improvements permit of a larger capacity. There were 1485 men employed at the works.

On January 7, 1918, service bonuses were paid to 2286 employees, the amount being $181,120.

Morenci Branch

Development: strikes caused a shut-down for almost four months. Ore-reserves were considerably increased. The four mines produced 324,516 tons of mixed ores.

Concentrator: the mill dressed 312,225 tons assaying 2.33% copper, making 46,047 tons of concentrate carrying 11.20%. Tailing averaged 0.648%, giving a recovery of 70.78%. Results are considered disappointing, due to the abnormal conditions. The flotation plant is to be enlarged.

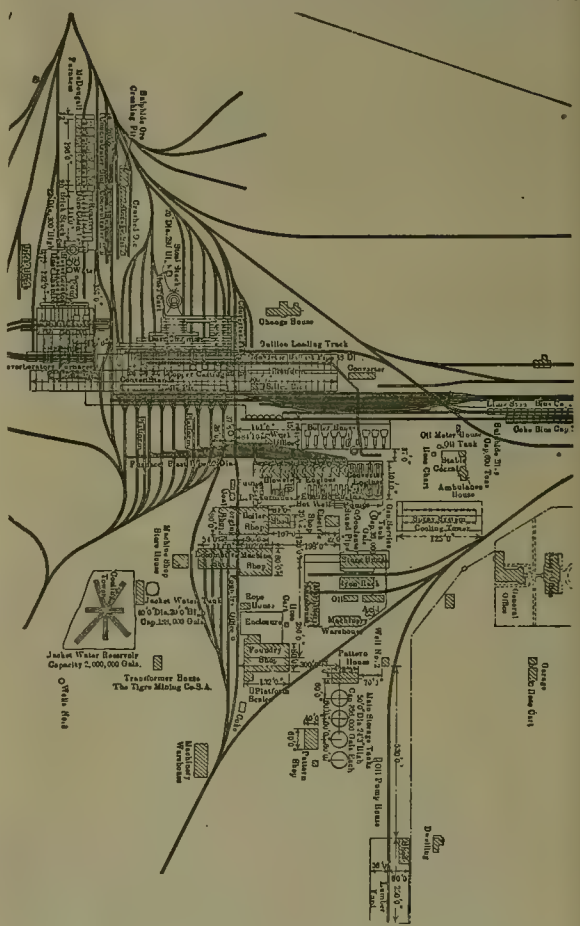
Smelter: the blast-furnace reduced 118,596 tons of charge, yielding 13,203,401 lb. copper. By June 1918 there should be two 1000-hp. Diesel engines in the power-plant. Another is to be ordered also, and one 3700-cu. ft. Diesel air-compressor.

Employment was given to 1192 men.

Burro Mountain Branch

Development: churn-drilling exposed ore at several points. A total of 30,542 ft. was drilled, 52 holes averaging 587 ft. Underground the number of tons opened per foot of development was 37.8, an increase of 16.3 tons. To block out a ton cost 21c., a decrease of 4c. The Thistle and Mohawk deposits are being prepared for extraction and larger tonnage for the mill when it is enlarged. Reserves were substantially increased.

Concentrator: 473,443 tons of 1.972% ore was dressed to 45,681 tons assaying 14.775%. Residue contained 0.606%,



Plan of Copper Queen Smelter, Douglas, Arizona

giving 72.258% recovery. Including lessees ore and precipitates the yield was 14,253,391 lb. copper and 39,404 oz. silver. Experiments are to be made in leaching ore below milling grade.

At the power-plant there were to be four Diesel engines working by May 1918. A Diesel air-compressor was started last November.

There were 928 men employed. Considerable progress was made at the townsite.

Copper Basin Branch

Development: a total of 1250 ft. of work was done. Reserves compare favorably with those of a year ago.

Production: of 17,299 tons shipped, 11,658 went to the

smelter at Clarkdale, 4253 tons to Douglas, and 1388 tons to Humboldt. Copper content was 934,781 lb., returning $166,090.

Stag Canon Branch

Production: coal from the six mines totaled 1,406,079 tons, an increase of 33,825 tons. Of this, 767,601 tons was sold to railroads, and 112,566 tons to other consumers. Washed coal amounting to 489,859 tons made 306,455 tons of coke, a slight increase. There were six fatalities.

Moctezuma Copper Co.

Development: prospecting and exploration totaled 33,823 ft. Reserves increased considerably, mainly below the Porvenir tunnel-level. The new Pilares shaft is to be sunk and equipped to supersede the present one, now in ore. The Churunibabi mine is shipping ore direct to Douglas. Work at La Caridad was greatly retarded. The Promontorio has been discouraging.

Concentrator: 750,897 tons of 3.179% ore produced 156,067 tons of concentrate assaying from 12.284 to 13.141% copper. Tailing contained 0.747%, making a recovery of 81.19%. The flotation plant is to be improved, especially in the slime department.

Bunker Hill Mines Co.

Development: the advance last year was 11,598 ft., but results were not encouraging.

Production: the mine yielded 69,418 tons of various ores, an increase of 10,119 tons. The mill dressed 16,075 tons of gold-silver-lead ore and 28,672 tons of manganese ore. Shipments consisted of 2872 oz. gold, 397,253 oz. silver, 1,049,445 lb. lead, 13,357 lb. copper, 2106 lb. molybdenite, 3355 tons of manganese, and 471 tons of manganese dioxide. Lessees also produced 1763 tons of lead-copper-silver-gold ore.

There were 386 people employed.

Phelps-Dodge Mercantile Co.

Gross sales amounted to $9,789,639, an increase of $1,383,003. The net profit was 8.42%, a drop of 1.96%. During 1917, 34.6% of sales was to company's employees, the remainder to outsiders and the trade. A new store was opened at Tyrone, New Mexico, where sales totaled nearly $1,000,000. There were 620 people employed at the stores and general office, 24% being women.

AURORA CONSOLIDATED MINES CO.

Property: gold mine and mill at Aurora, Mineral county, Nevada; controlled by Goldfield Consolidated Mines Co.

Operating Officials: J. W. Hutchinson, general manager; W. M. Dake Jr., general superintendent.

Financial Statement: sales of bullion in 1917 amounted to $404,558 net, plus $11,153 from sundries. Operations cost $434,499, leaving a loss of $18,787. Interest and depreciation increased the loss to $48,978. This, with previous deficit, made a total deficit of $607,137.

Development: new openings amounted to 3993 ft. Results on the whole were not encouraging. Some prospecting was done in the old Juaniata workings, under water since 1872. At 85 ft. above the main haulage-level the vein was found exposed for 260 ft., half of which had been stoped. It is 8 ft. wide, increasing to 18 ft. on the east. A 90-ft. section assays $4.50 per ton, and one cut for 10 ft., $20 per ton. With the Juaniata Extension claim the company has 5000 ft. along the strike, and the vein may prove of considerable importance. An arrangement was made to work the Silver Lining mine adjoining. An indicated ore-shoot is 250 ft. long, worth $10 per ton, and about 75,000 tons of $8 ore is estimated to be available.

Production: the mill treated 175,447 tons of ore assaying $3.32 per ton, of which 82.15% was extracted.

Costs: these totaled $2.48 per ton, mining being 92.6c., treatment $1.297, and general 26.3 cents.

ROUND MOUNTAIN MINING CO.

Property: gold mine and placer deposits and mill in Nye county, Nevada.

Operating Official: Gibson Berry, general superintendent.

Financial Statement: revenue from gold totaled $225,586. All charges, including $28,910 for depreciation and $22,638 for taxes, etc., were $153,383. The profit was $72,204.

Dividends: none were paid, so the total remains at $363,965.

Development: practically no new work was done, but during four months the mill ran on bulk samples from four separate sections in the mine. These resulted as under, for the three, the other being too poor to finish:

	No. 921	No. 710	No. 473
Ore treated, tons.....	1,422	1,102	1,184
Average value	$3.20	$1.60	$1.27
Extraction, per cent.....	78.5	83.8	76.3

Section 921 contains considerable ore, offering favorable inducements for exploitation under normal conditions. The mill was stopped in September. In the above tests, treatment was varied to determine the best method. Several lessees are working in the mine, also on bedrock of the placer area.

Pipe-lines and other equipment for hydraulicking are in good condition. An earth dam was built in Jett canyon, 8 miles distant. The main tail-race was lengthened 1269 ft., making it 4280 ft. long. Supplies on hand for extensions are ample for some time. Rail liners in the flume are entirely successful, so is blasting the gravel ahead of sluicing.

Production: 12,118 tons of ore averaging $7.21 per ton was milled. The extraction was 89.9%. There was hydraulicked 127,788 cu. yd. of gravel, averaging $1.0956 per yard. Bedrock cleaning yielded $15,353 additional. Total ore milled to date is 411,015 tons, worth $3,091,595.

Costs: mining and milling were $2.176 and $2.183 per ton, respectively. Placer operations cost 37.3c. per yard, labor accounting for 83.5%.

SHATTUCK ARIZONA COPPER CO.

Property: copper-lead mine in Bisbee district, Arizona.

Operating Officials: L. C. Shattuck, general manager; Arthur Houle, superintendent.

Financial Statement: gross income from all sources was $3,652,156, of which $3,609,989 was from metals sold. Operations cost $2,174,656, leaving a profit of $1,477,500. After deducting dividends and depreciation the 1917 surplus was $101,141.

Dividends: four absorbed $612,500, making $6,562,500 to date, equal to $18.75 per share.

Development: new openings amounted to 15,793 ft., down to 900-ft. depth, only 23 ft. being done at this point. Total openings are 127,855 ft. Tunnels 5984 and 5903 showed some silicious manganese. On 100-ft. level the most important development of the year was opened. A lens, 110 ft. long, 25 ft. thick, and 60 ft. wide, assays 30% copper, 12 oz. silver, and $2 gold per ton. Around this ore is a silicious ore assaying 15% lead, 8 oz. silver, and $1.60 gold per ton. Much lead-silver and promising leached copper ore was opened. Old stoping ground on 700-ft. level continues to yield new orebodies of importance. Work at 800 ft. has not opened any commercial ore. Sinking to 1000 ft. was to be done early in 1918.

Production: ore shipped amounted to 130,645 dry tons of copper ore and 6804 tons of special ore. These yielded 11,935,317 lb. copper, 2,010,145 lb. lead, 1542 oz. gold, and 154,344 oz. silver.

Costs: these were $10.01 per ton of ore, and 13.242c. per lb. of copper. A 400-ton mill, using Minerals Separation process, was expected to be working by May 1918.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

SMOOTH-ON CORRUGATED IRON GASKETS

The maintenance of tight connections on flanged-joint pipe-lines is often a source of trouble. Such joints actually seem to delight in leaking at critical times and at inaccessible places. A permanently tight gasket, that when once placed can be forgotten with assurance that it will never cause trouble, should win instant recognition. The Smooth-On corrugated iron gasket is coming into wider use in mines, particularly for high-pressure steam and for air-lines, because it invariably makes a joint that lasts as long

as the pipe itself. Smooth-On gaskets are made from sheets of specially prepared iron, rolled with concentric corrugations, and then coated with Smooth-On elastic iron cement No. 3. It is the peculiar property of this cement to metallize and to expand when metallizing, which makes the Smooth-On gasket permanently leak-proof, since it completely fills the irregularities in the flange-faces. Being of iron throughout, the gasket expands and contracts with the pipe, and so the parmanency of the joint is never impaired. There are many cases on record where after years of service without a leak, Smooth-On gaskets have been removed in dismantling a line and have been found to be uninjured. By again coating with Smooth-On elastic cement No. 3 they were ready for use in a new place. Smooth-On gaskets are made for all sizes of pipe from 2 to 24 in., and for pressures up to 250 lb. Both narrow and full-width gaskets are made in each size. The narrow gaskets cover the surface of the flange-face inside the bolt-line circle and are recommended for general use, and costing less than the full-width gaskets which cover the entire flange-face.

INDUSTRIAL PROGRESS

Manufacturers of many articles have found it expedient to take advantage of the Argentine protective tariff to open branch factories in that republic. The same thing is likely to happen in Chile. The Sociedad de Fomento Fabril, of Santiago, has proposed protective duties on a long list of manufactures. Those that concern the mineral industries are: plows and harrows, galvanized iron pails, bolts and rivets, sheet iron, aluminum and copper kitchenware, structural iron, iron cut nails, wire nails, iron benches, crown tops, automobiles, chemical products, enamel components, paints and ochres, chalk, cement, matches, inks, tanning extracts, dentrifices, and talcum. In addition to the increase of duties on the goods enumerated the council of the Society is giving serious study to the matter of organization and nationalization of commerce for further protection against aggressive foreign competition.

The Rare Metal Products Co., Glen Ridge, New Jersey, is planning to increase the capacity of its plant, and has acquired the works of the Seton Chemical Co., of Belleville, New Jersey, consisting of a manufacturing building 400 ft. long with auxiliary structures aggregating a total of about 30,000 sq. ft. of floor-space, and covering an area of 7½ acres. The consideration for the property is said to be $150,000. The plant will be used by the company for the manufacture of antimony and other metal products.

The Finance Exploration & Development Corporation of America has been incorporated under the laws of the State of New York for the purpose of investigating and financing mining, oil, and industrial enterprises. An initial capital of $500,000 has been provided. This corporation will maintain a staff of skilled engineers to examine the merits and possibilities of enterprises needing additional capital for development or expansion. The directors are William R. Jones, Jackson B. Sells, Burt Brown Barker, E. L. Kerstetter, and Homer L. Carr. Mr. Carr is consulting mining engineer for the corporation, with offices at 50 Broad street, New York City.

The Compressed Air Society, upon the recommendation of its Technical Committee, has adopted the following definitions of certain compressed-air terms in order to eliminate confusion:

The displacement of an air-compressor is the volume displaced by the net area of the compressor-piston.

The capacity should be expressed in cubic feet per minute, and it is the actual amount of air compressed and delivered, expressed in free air at the intake-temperature and at the pressure of dry air at the suction.

Volumetric efficiency is the ratio of the capacity to the displacement of the compressor, all as defined above.

Compression efficiency is the ratio of the work required to compress isothermally all the air delivered by an air-compressor to the work actually done within the compressor-cylinder, as shown by indicator-cards; it may be expressed as the product of the volumetric efficiency (the intake-pressure and the hyperbolic logarithm of the ratio of compression), all divided by the indicated mean effective pressure within the air-cylinder or cylinders.

Mechanical efficiency is the ratio of the air-indicated horse-power to the steam-indicated horse-power in the case of a steam-driven, and to the brake horse-power in the case of a power-driven machine.

Overall efficiency is the product of the compression-efficiency and the mechanical efficiency.

The Society further recommends that the use of other expressions of efficiency be discontinued. Communications regarding this and related subjects may be sent to L. D. Albin, the secretary, at 30 Church street, New York.

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AN INDEPENDENT PAPER OWNED EDITED, AND MANAGED BY ENGINEERS

WE FURNISHED THE

UNITED STATES GOVERNMENT

1,705,429 FEET REMCO PIPE

Camp	Feet
Camp Devens, Mass.	85,227
Camp Taylor, Ky.	17,803
Camp Jackson, S. C.	73,884
Camp Dix N. J.	14,548
Camp Pike, Ark.	59,283
Camp Dodge, Iowa	95,084
Camp Gordon, Ga.	13,128
Camp Fremont, Cal.	68,308
Camp Kearny, Cal.	61,616
Camp Merritt, N. J.	23,020
Camp Custer, Mich.	7,004
Camp Cody, N. M.	16,410
Camp Wheeler, Ga.	9,091
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Gerstner Field, La.	21,447
Embarkation Camp, Va.	16,015
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Engineer Depot, France	189,411
Camp Stuart, Va.	71,202
Love Field, Texas	13,807
Raritan River Ord. Dep., N. J.	16,854
Kelley Fields, Texas	84,697
Brooks Field, Texas	4,212
Pig Point Ord. Dep., Va.	4,634
Coastal Aero Station, Fla.	1,000
Ebbetts Field, Ark.	9,801
Ordnance Depot, Md.	7,150
Camp Humphreys, Va.	8,000
Mills Field, Cal.	9,925
March Field, Cal.	10,656
Explosives Plant, W. Va.	16,500
Quartermasters' Termnals, S. C	58,356
Army Camp, Texas	6,302
Camp Eustis, Va.	65,035
Navy Yard Vallejo, Cal.	8,000
Marine Training Camp, Va.	20,955
Camp Perry, Ohio	15,913
Camp Sevier, S. C.	4,005
Camp Travis, Texas	11,733
Camp Jones, Ariz.	7,806
Camp Shelby, Miss.	28,000
Camp Sheridan, Ala.	25,904
Camp Wadsworth, S. C.	34,484
Camp Lee, Va.	3,601
Norfolk Q. M. Terminals, Va.	10,138
Camp Logan, Texas	22,000
Camp McArthur, Texas	23,000
Camp McClellan, Ala.	38,400
Q. M. Corps, Construction Div.	198,100

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Camp	Gallons
Camp Devens, Mass.	400,000
Camp Taylor, Ky.	1,000,000
Camp Upton, N. Y.	850,000
Camp Meade, Md.	400,000
Camp Pike, Ark.	1,200,000
Camp Sherman, Ohio	400,000
Camp Gordon, Ga.	1,000,000
Camp Funston, Kan.	800,000
Camp Custer, Mich.	400,000
Camp Wadsworth, S. C.	700,000
Camp Wheeler, Ga.	500,000
Camp Cody, N. M.	300,000
Camp Sevier, S. C.	400,000
Camp Shelby, Miss.	400,000
Camp McArthur, Texas	200,000
Camp Greene, N. C.	400,000
Camp Logan, Texas	400,000
Camp Stuart, Va.	1,600,000
Camp Johnston, Fla.	400,000
Ellington Field, Texas	60,000
Engineer Depot, France	387,300
Love Field, Texas	275,000
Fort Caswell, N. C.	200,000
Pig Point Ord. Dep., Va.	230,000
Kelley Field No. 1, Texas	100,000
Dorr Field No. 2, Fla.	200,000
Ebbetts Field, Ark.	100,000
Taylor Field, Ala.	100,000
Ordnance Depot, Md.	899,000
Mt. Clemens, Mich.	120,000
Camp Tallaferro Fields, Texas	
No. 1, No. 2, No. 3.	300,000
Fort McHenry, Md.	200,000
Coastal Aero Sta., Fla.	101,000
Call Field, Tex.	100,000
Camp San Juan, Porto Rico	400,000
Gen. Hospital No. 3, N. J.	200,000
Fort McPherson, Ga.	200,000
Mechanical Repair Shop, Md.	200,000
Tuberculosis Hospital, N. Y.	420,000
Chemical Plant No. 4, Va.	649,000
Park Field, Tenn.	100,000
Navy Yard, Pauillac, France	100,000
U. S. Explosives Plant, Tenn.	1,054,300
Queenstown, Ireland	100,000
Guantanamo, Cuba	47,000
Payne Field, Miss.	100,000
Southey Field, Ga.	100,000
Clearing Hospital, N. Y.	200,000
Mills Field, Cal.	175,000
March Field, Cal.	75,000
U. S. Explosive Plant, W. Va.	600,000
U. S. Hospital, N. C.	300,000
Camp Eustis, Va.	600,000
Camp Sevier, S. Schenectady, N.Y.	400,000
Q. M. Dep., E. Columbus, Ohio	400,000
Q. M. Dep., New Cumb., Pa.	400,000
Ordnance Depot, Pa.	200,000
Marine Training Camp, Va.	1,250,000
Filtration Units, France	1,251,200
Aviation Concentration & Supply Depot, L. I.	100,000
Camp Perry, Ohio	300,000
Aerial Gunnery School, Fla.	200,000
Camp Jones, Ariz.	100,000
Q. M. Term., Charleston, S. C.	400,000
Raritan River Ord. Dep., N. J.	50,000
Coast Defense, Pensacola, Fla	400,000
Final Testing Field, Dayton, O.	100,000
Q. M. Corps, Construction Div.	6,000,000

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The Menace to Gold Mining

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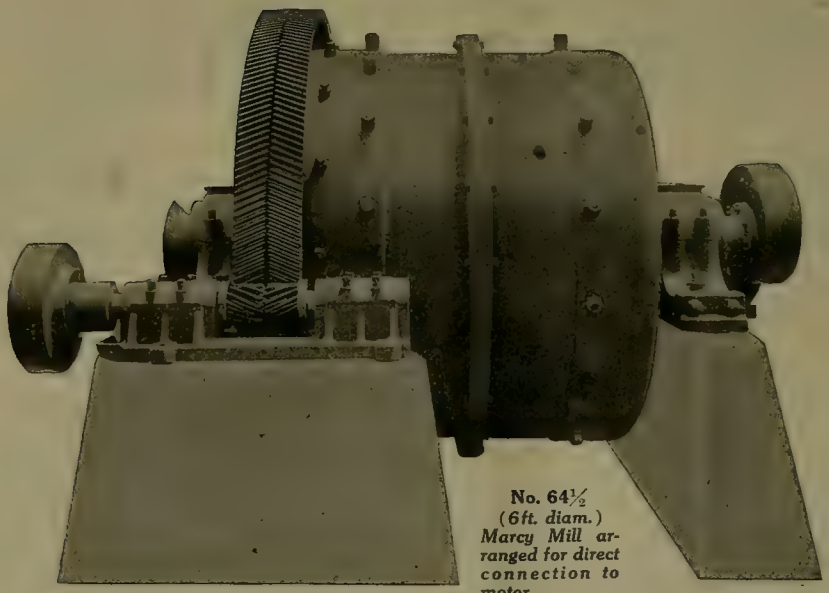

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BEER, SONDHEIMER & CO. and L. Vogelstein & Co. have passed into the hands of the Alien Property Custodian, Mr. Mitchell Palmer, who is reported to have said that he had taken "another step to crush the German control of the metal industry in this country." *Qui vivra, verra.*

IMPORTATION of chrome ore from Cuba, Guatemala, Newfoundland, and Brazil will be permitted by the War Trade Board; the amount, however, is not to exceed 43,500 tons for the period ending March 31, 1919. Permission is given also to bring 10,000 tons from New Caledonia this year. No restriction is imposed upon receipts by land from Canada or Mexico, nor upon shipment as return cargo from European ports when no delay is involved in loading.

MAPS are essential to any geographic description. It is curious how little the average publisher appreciates this fact. Such maps as our daily press give us in order to explain the battles in Europe might be the work of high-school sophomores. There is no excuse for them. Accurate maps of France are available and could be reproduced daily in short order. That is where the New York 'Times' and other first-class newspapers show that they are well edited. No account of strategic moves is intelligible without maps drawn accurately to scale.

CHANGE of name of the American Institute of Mining Engineers has been approved by the Board of Directors and a proposal to that effect will be submitted to members at an early date. The name is to be changed by inserting 'and Metallurgical' before the word 'Engineers.' The idea is to be more specific and comprehensive, but the effort made to recognize the inclusion of metallurgists has the immediate effect of excluding chemists and geologists, among others, for these are neither mining nor metallurgical engineers. We cannot see any advantage in the change of name; on the contrary, we see several disadvantages, besides the one to which we have referred. Another is the fact that the present name has served for nearly half a century and has become honorably known all over the world. A third is the greater probability of confusion with the Mining and Metallurgical Society of America, which exists to do the things that the Institute does not care to do and serves as a nucleus of disaffection whenever the Institute needs discipline.

COLORADO is to have the next meeting of the Institute. The sessions will begin at Denver on September 2, to be continued at Colorado Springs on the succeedings days, and followed by excursions to Cripple Creek, Pueblo, Leadville, and Boulder. Arrangements are in the hands of a strong committee, headed by Mr. Spencer Penrose. An effort will be made, naturally, to discuss the production of minerals in relation to the War and to stimulate the work of the profession in behalf of the Cause.

PATRIOTISM finds various forms of expression. A correspondent to the 'Chronicle' writes to suggest that the 'German' name for the month of August be replaced by the 'American' name of Samuel. The gentleman that makes this illuminating suggestion is called Jacobs, a good old Anglo-Saxon patronymic, of course. We knew that the Pan-Germans claimed most of the great men of the past, from Jesus to Dante, as theirs racially, but Augustus Caesar had a pedigree such as might permit him to escape the imputation of being a descendant of the barbarians whom his uncle Julius fought so successfully.

FROM the 'Financial Times,' of London, we learn that the Goerz company has purchased from the Custodian of Enemy Property in South Africa the 347,803 enemy-owned shares in that company and that these shares are to be offered to British and Allied shareholders at 13 shillings each, as against the current market-price of 14 shillings. This is an interesting precedent. According to our London contemporary, the enemy holdings in South African companies include 100,000 shares in the Goerz company, 106,900 in Consolidated Mines Selection, 110,000 in East Rand Proprietary, 458,800 in General Mining, 298,000 in Geduld, 266,700 in New Modderfontein, 224,250 in Van Dyk, and 307,200 in West Rand Consolidated, besides 435,050 shares in three other companies. In some cases these enemy holdings constitute a control; thus the New Mod-

derfontein company is capitalized at 350,000 shares, the General Mining corporation has 1,875,000 shares, the Geduld 875,000 shares issued, and the Van Dyk 500,000 shares issued. A block of shares even less than the majority will suffice for the control of a company. It remains to be seen whether these other enemy holdings will be treated according to the Goerz precedent.

SULPHUR and pyrite are in greater demand than at any time since the War began, partly because of the steady increase in the manufacture of munitions to meet the needs of a growing Army at the front, and partly as a necessary consequence of curtailing the importation of Spanish pyrite. No one knows when vessels again may be available for bringing more than the 10,000 tons per month allowed by the Shipping Board. In order to ensure a supply of acid-making material the War Industries Board has named Mr. William G. Woolfolk as controller of sulphur and pyrite, with authority extending to production and distribution of these essentials.

THAT the frank demand of the British Labor Party for a completely socialized government has not met with sympathy among the leaders of labor in this country is indicated by the refusal of the New York State Socialist Party to endorse a plank calling for a two weeks vacation, with pay, every year for workingmen. The reason for voting down the proposal shows that the spirit of American individualism still lives. The objection, as stated by Mr. Joseph D. Canon, was that "we are drifting now from the capitalist system, or 'stateism,' as it is called, and it may be more difficult for us to get anything from stateism than it is now from capitalism. Let us keep away from this dangerous legislation." The fact that the Socialists themselves recognize and fear the autocracy that lies at the heart of their system is a sign that the old order is not likely to be destroyed in this country. Democracy is a happy mean between the self-appointed autocrat, whom we call czar or kaiser, and the elected autocrat, whether represented by an individual or a governing board, charged with the administration of a socialized commonwealth. When the Labor party in a densely populated State like New York, where the evils of the factory system are near the maximum, still clings to the sweets of individual liberty, it is certain that the men of the West, who meet the opportunity of independent fortune more often that their brothers in the East, will not consent to enslave themselves under a form of government that would reduce them forever to the status of wage-earners.

ON July 1 the law organizing a zonal system of postal rates went into effect. The law establishes eight geographic zones at progressively increasing distances from the place of publication, and the payment of postage at correspondingly higher rates, ranging from ¼ cent per pound to 2¾ cents, a maximum of 3¼ cents per pound for the first year as against the former uniform rate across the continent of one cent per pound. These rates are to be increased each year for four years until the maximum rate will be 10 cents per pound. This is equivalent to an increase of from 50 to 900% above the old flat rate. Needless to say it represents a heavy burden on the business of periodical publications. Many journals and magazines will be unable to carry the weight of taxation and will succumb. In order that any publication may survive it will be necessary to distribute the additional cost between the producer and the consumer, that is, between the publisher on the one side and the reader and advertiser on the other. This new tax comes on top of a series of increases in expenditure, particularly the abnormal cost of paper and other supplies, not to mention wages. In 1916 we raised our subscription rate from $3 to $4 per annum, and it was accepted in the best possible spirit by our readers, who, apparently, recognized that a successful effort had been made by us to give them better value for the money received. No increase in advertising rates has been made, because the expanding volume of advertising has helped to overcome the cost incidental to abnormal conditions created by the War. We are grateful both to our readers and to our advertisers for their loyal support in these strenuous days; we intend to sit tight, making no increase either in the rates of subscription or of advertising at least for the present, in the hope that Congress may repeal or modify this destructive legislation. We hope to weather the storm of war without further changes in our rates and we intend to do our utmost to make this paper increasingly useful for the great cause to which every good citizen is committed heart and soul.

A wise movement has been started by a progressive manufacturer of mining machinery for establishing in Washington a bureau consisting of representatives of the leading makers of such appliances to co-operate with the War Industries Board and other committees in order to facilitate the production of the equipment needed in the mining operations of the country. It transpires that no co-ordination of the makers of machinery with the government agencies concerned in producing raw materials has been undertaken. The proposal to effect a voluntary organization for this purpose is commendable. Manufacturers of machinery have been severely handicapped in their efforts to obtain the iron and steel and other necessary metals on account of the priority advantages accorded to shipbuilding and some other industries. No one questions the wisdom of discriminating in their favor, but it must be apparent that the effect of crippling the mines by making it difficult to obtain mechanical equipment, must react in the end disadvantageously upon the output of ships and of other essentials for the conduct of the War. The plea of individual manufacturers of mining machinery may be overlooked, but combined action will command attention. It is to be observed also that such an association as is now proposed would make it possible to distribute orders in accordance with the abilities of the firms to make early delivery. In

this respect it would be possible to adopt the principle of the cartel, which played so important a rôle in giving solidarity to industrial effort in Germany before the War. We should not hesitate to appropriate a good idea from the Enemy, if, by so doing, we may increase our efficiency for overcoming him.

The Russian Crisis

On another page we publish the text of an address delivered by Mr. Fedor F. Foss before the Engineers Club of San Francisco. Mr. Foss is a member of a Russian mission to the United States and chairman of the mining committee of that mission; he came to this country in September last for the purpose of studying American mining and metallurgical industries, and particularly their relation to Government administration, technical societies, educational facilities—in short, anything contributing to the development of the profession and of the industry. He is a graduated mining engineer of the late Imperial Mining Institute at Petrograd; in politics he stands as a constitutional democrat, so that his point of view is largely that of the first provisional government organized by Lvoff, Milyoukov, and Rodzianko. His professional and financial connections with important enterprises in Russia enable him to speak authoritatively and sympathetically. The engineers that heard the address were impressed by the plea made by him for assistance from America to Russia, and by his reminder that the Russians had fought and died unflinchingly for the Allied cause until demoralized by German chicane. The spectacle afforded by the Russian retreat and political chaos has moved some of us to a cynical contempt, for which, on second thought, we ought to be sorry. Such a mental attitude can do no good. Russia is a great fact. Her sudden effort to rid herself of a corrupt bureaucracy headed by a weak autocrat moved our enthusiastic approval because we hailed it as a first step to the establishment of democratic government, but when the effort as suddenly degenerated into soap-box oratory, political buffoonery, and industrial nihilism, we were repelled and disgusted. Mr. Foss and other good Russians ask us to be patient; they tell us that the Russians are 80% illiterate, that politically they are children, easily misled, but with good instincts. Russia is in travail and we must stand by her in her dark hour, for the sake of the democratic ideals we hold dear and in the name of Abraham Lincoln. The President stated explicitly on May 18 that he intends "to stand by Russia as well as France." On June 9 he told the Mexican editors that we want nothing out of this war, which "so far as we are concerned is for idealistic objects." That is exactly why the United States can do more to help Russia than any other of the Allies. England, France, or Japan might be suspected to indulge ambitions of territorial aggrandizement or of commercial penetration. Foreign bondholders are unacceptable as political mentors. The United States has no pecuniary bias in her efforts at rehabilitating Russia, she does not desire to possess an acre of Russian territory, nor have our people made heavy investments of the kind that prevent Paris and London from being disinterested in the details of Russian re-organization. The President is about to appoint a commission, which, we presume, will report on the subject to him, for the purpose of guiding his future action. Meanwhile several thousand American marines are said to be co-operating with the British in keeping open a door into Russia on the Murman coast of the White Sea, near Kola and Alexandrovsk, which are accessible to navigation the year round. If any help is to be given, moral or physical, it is necessary to keep this door open. Whether an expeditionary force will be landed on this sub-Arctic coast, to march southward, is a matter that may not arise immediately. Obviously no army, whether of American soldiers or of other Allied troops, can accomplish any good without invitation and support from the party around whom, sooner or later, the Russian people may be expected to rally in an effort to restore order, and to drive out the German invader. The treaty of Brest Litovsk has proved to be a scrap of paper under cover of which the Prussian outlaw gave an air of legality to his scheme of spoliation. The seizures of grain and other supplies from the peasants under cloak of military necessity have opened the eyes of the Russian peasants to the menace of German depredation. Up to the present the German propaganda has succeeded in making the Russians fearful of the coming of an Allied expedition, and rendered them ready to oppose such intervention, which cannot be done effectively so long as it is regarded inimically by those whom it is intended to help; but a propitious moment will come, when the Russians have realized that none of the Allies, not the United States only, desires to annex Russian soil. Meanwhile the forces of reaction, not against constitutional reform, but against the savage anarchy of the Bolshevist mob, are crystallizing. The Czeko-Slovaks, who, in great numbers, deserted or were made prisoners when the Austrian armies were routed in 1915 and 1916, have organized themselves into several corps, one of which is acting as a nucleus of opposition to the Bolshevist misgovernment in Siberia. Another body of Czeko-Slovak troops has captured Kazan, the old Tatar capital, and dominates navigation on the lower reaches of the Volga. Generals Korniloff and Alexieff have been reported at the head of troops insurgent against the Bolshevist cabal. The news is fragmentary and confusing, for it comes from different parts of a region three times as large as the United States, but it suggests the growing opposition to the forces of anarchy now endeavoring to secure themselves in authority under German patronage and gives promise of a concerted attempt to re-establish order. This opposition to the German-Bolshevist party should be utilized in the interest of Russia and the Allied cause, which is that of democracy in Russia, as elsewhere. The independence of Siberia is well worthy of American recognition and support: it is being aided by the Czeko-Slovak troops that were on their way to France, by way of the trans-

Siberian railroad, when, contrary to their intentions, in self-defence, they had to capture Vladivostok, in conjunction with Allied naval forces. This Czeko-Slovak army controls 1300 miles of the railroad and, assisted by a Japanese-American expeditionary force, should soon be in a position to strike at the German invaders. Such a move, together with a flank attack from the north, from the Murman coast, would re-create an eastern front to which the Germans would have to re-direct their military energies, causing a diversion of incalculable help to the Allied offensive in the west, in France and Flanders. Any such move should be accompanied by a well-organized effort to lend economic assistance to the Russian people, thereby blocking the German scheme to exploit Russian resources, and eventually to mobilize the Russian peasantry on the side of the Prussian military machine. This war is no parochial affair; it is one of terrestrial amplitude, and must be viewed in a comprehensive way if it is to be brought to the one necessary conclusion.

The Status of Gold Mining

We return to this subject, because it is of immediate interest to most of our readers. On another page we reproduce the larger part of the testimony given by Mr. Hennen Jennings before the Committee on Ways and Means of the House of Representatives. He lays stress on the fact that the Allied countries produce most of the gold of the world, the British dominions and the United States, as we have remarked more than once, contributing about 85% of the total. Russia normally yields 5% more. Of the gold produced in neutral countries, it may be asserted that the major part of it is won by aid of British capital and by Anglo-American engineers. The enemy countries contribute barely 1% of the world's gold production. Why should we voluntarily relinquish this advantage by allowing any obstacle to handicap the vigorous exploitation of gold mines? It is the basis of credit, whatever people may say, and we must not allow the exaltation of war finance to becloud this fundamental fact. We published Mr. Jennings' essay on this subject six weeks ago. His colloquy with the Committee is interesting, if only to indicate the mental processes of the gentlemen participating in the deliberations. In passing, we venture to suggest that public documents should be revised before they are issued; the witnesses whose statements are reported ought to read the record, to protect themselves from errors, even in the preliminary issue, and the entire record should be read by a competent proof-reader, if not by an editor. We have protected Mr. Jennings against two or three obvious typographical slips, but the entire report of the proceedings shows the lamentable lack of revision. The members of the Committee appear to have been impressed with the value of iridium and depressed at the thought of its effect upon the gold standard. If mere 'preciousness' were the thing to keep in mind, why not elevate tantalum to the position of a monetary metal, or scandium, which would cost as much as $10,000 per ounce at least. To Mr. Rainey the suggestion may seem tantalizing, if not scandalous. His colleague, Mr. Sloan, objects to platinum because it is not "as desirable for the vision," which is true, for a $20-gold piece is indeed "a treat for sore eyes." Gold happens to have been selected as a monetary metal partly for that reason: it is beautiful; moreover, it does not corrode; it is heavy; it is distributed in nature in proportions rendering it neither too rare nor too common. It is more than a coincidence that the production of gold should have increased with the growth of base-metal mining and with the expansion of general industry. At the meeting of the Central Mining Corporation, in London, Sir Lionel Phillips acknowledged that "but for the British navy, the gold-mining industry would have come to a standstill." So would many other necessary activities. He made a friendly protest against the adverse exchange incidental to the purchase of South African gold by the Bank of England. The standard price was 85 shillings per ounce, whereas "the small amount now permitted to be used for trade purposes has risen to 115s. per fine ounce." He added: "That the raw gold from South Africa is worth more than the price paid for it in paper currency is not a difficult matter to demonstrate in general terms." The rates of exchange are not the true measure of its value, because it is used partly to regulate those rates, and without our [South African] gold the adverse exchanges would have been still higher. . . . If we could have paid for our commodities [mine and mill supplies] in our own gold, instead of depreciated paper, we should have obtained due compensation in value for part of the increase in working costs." These quotations from Sir Lionel's speech are given verbatim because they will find a ready response among those operating gold mines in the United States. In Canada similar ideas are fermenting. The Minister of Mines in British Columbia has approved the suggestion that all war taxes be remitted to gold-mining companies, that the increased freight-rates be abrogated in favor of low-grade gold mines, and that gold-mining be afforded such assistance as is being granted to other war industries. It is evident that the gold-mining industry of the world is becoming articulate and is asking for such public national support as it deserves. We are glad to note the announcement made on July 13, by the War Industries Board, that gold-mining has been listed as an essential industry, and all reasonable priority on material and supplies used in the production of gold will be given by the Priorities Committee. This action was taken at the request of the Treasury Department. It remains to interpret this decision. We hope that it will mean a remission of special war taxes, relief from increased freight-rates, acceleration of shipments of machinery, a check upon excessive prices on explosives, chemicals, and other supplies, and the prohibition of recruiting labor from gold mines to mines producing the base metals. All this will help, but more will have to be done if gold mining is to be kept alive.

Chilean Nitrate Deposits

The Editor:

Sir—There has just come to hand the copy of the MINING AND SCIENTIFIC PRESS of March 23, in which I note extended comment, in the New York letter, on the Chilean nitrate situation. The identity of your correspondent is unknown to me, but it is proper to state that his viewpoint is one which cannot be endorsed completely by those resident in this country and familiar with the business of nitrate production. Questions of nitrate as a war-material, and as a fertilizer, are of such importance to the United States, both now and in time of peace, that mistaken impressions should be corrected, lest they might affect in some way, the American viewpoint. To quote from the article mentioned, "Intending purchasers (of nitrate land) know exactly what they are buying." There are several well-known episodes in the recent history of the nitrate business, involving some of the large producers, in which the principals thought they 'knew exactly what they were buying,' but development and exploitation of the ground showed later a large and painful discrepancy in nitrate content. One property, well known in the nitrate world, has had reports upon its possibilities, based upon examination by qualified men, and these reports varied from a gross content of millions of quintals, to an estimate that gave no net recoverable value to the property at all. Discarding such exaggerated differences in conclusions, it is clear that there will always be room for honest differences of opinion on the reserve of caliche, in unexploited 'pampa.'

It is unsafe to infer that all estimates made by the Chilean government engineers for the Fisco, show less than the quantity available, since, by careless work (which is usual), the existence of barren patches may as easily pass unnoted as that of rich 'papas,' or bunches of high-grade material. The statement that "cost of Chilean nitrate may be lessened in spite of the frequent assertions to the contrary," is interesting, and I believe it to be true, but not for entirely the same reasons as those advanced by your New York contributor. To one who knows the pampa, it reads like an ill-timed jest, when the suggestion is advanced to boil the vats of a group of oficinas by steam generated in a central plant. The fuel consumed in the boiling of the caliche, in the present forms of treatment, is the largest single unit of cost, and this steam cannot be conveyed economically from one plant to another. As for steam generated for power-purposes, a central station to distribute electric power would be useful, but the saving afforded in fuel and costs would not be likely to bulk large when competing for low costs against synthetic nitrates, since the direct use of motive power at an oficina treatment-plant is relatively small, being largely confined to primary crushing, elevating crushed caliche, pumping solutions, and generating electric light. The oficinas of such companies as the Loa, or the Antofagasta, which are scattered over a tract of ground some 25 miles long by 6 miles wide, show the validity of this view. A late résumé of the economic situation in Chile, as affecting the nitrate business, written by F. Mella, of Santiago, which appeared in the MINING AND SCIENTIFIC PRESS, gives a very true sketch of the present difficulties, and the comparisons of pampa-power installations with high-grade metropolitan power-plants, like the Commonwealth Edison, for example, as suggested in the New York letter, are quite beside the point. The essential difference lies in the relative ease of distribution of power, and the permanence of the demand for it.

As to "an entire lack of any idea of centralization in the nitrate business," I agree, with some reservations. Your correspondent may not know that part of this diffusion of effort is enforced by an obedience to the Chilean mining code, which provided that only a certain maximum area of ground might be devoted to the purpose of nitrate making in a single oficina. This provision was supposed to guard the interests of the Chilean laborer, and thus always to supply him with numerous centres of employment. It is unfortunate, and has caused the erection of some small and economically unjustified oficinas, in the past.

The lack of co-operation complained of is more evident among the several companies than among the group of oficinas comprising any one company organization, as in most cases there is an effort to spread the overhead charges evenly among the various plants, and the staff-organizations of the oficinas cannot now be said to be excessively large, whatever they may have been before the War.

A much-needed innovation is the establishment of an organization analogous to the A. I. M. E., but limited to the nitrate industry, which would supply the mental stimulus and exchange of ideas that now is lacking entirely. Since the majority of the 'powers-that-be' in the nitrate business came by way of the book-keeper's office, it is not remarkable that the technique is not of an extremely high standard, and this fact operates strongly toward clinging to existing plans. Conservatism characterizes the industry generally, but there are marked exceptions, which are growing more and more numerous,

and this conservatism is, itself, not so much an indifference, as it is honest skepticism regarding the possibility of improvement, or else it indicates timidity in backing any novelty. The result has been rather amusing when it is realized that gyratory crushers, belt-conveyors, and recording conveyor-weighers are regarded as great novelties even at this time, while three years ago they were hardly known here.

"Lack of co-ordination in research-work" is true criticism, and it characterizes other phases of life in Chile, besides research work in nitrate making.

That the "techno-chemical problems involved in the treatment of caliche, and in the production of high-grade nitrate, are almost negligible," will be a welcome surprise to the energetic staff of oficina known as Delaware, in Taltal, Chile, where the Duponts have considered this problem as being far from "almost negligible," so much so that they have spent some years in arriving at their particular solution of the problem. Doubtless they will again be pleased when they hear that the "problems of a satisfactory recovery are entirely mechanical," when they bear in mind their own work on the important chemical conditions that govern the proper mechanical design of nitrate-extraction plants. The mutually inter-related action of the numerous dissolved salts, which exist in highly concentrated solutions all through the extraction-system of a nitrate plant, have been the basis of most interesting and profitable research by the chemists of the Dupont staff in Chile, as well as the equally important mechanical design.

When mentioning 'Delaware,' I do not wish to detract from research work by others in Chile, but it is a well-known fact that this oficina has maintained, and does now maintain, an unusually large amount of research study, and it is probably a more interesting example to American readers, on account of its American ownership, than any other oficina would be.

The concluding paragraphs of the New York letter are in general agreement with the facts. "Lack of co-ordinated research"; "hesitancy of the conservative owners to install modern equipment, due to dubious results afforded by up-to-date installations of doubtful applicability," are both truthful statements. "The autocratic control of all filter patents" was true at one time, but in the fall of 1917, the absurd claim of the representative of the Butters filter organization in Chile (Leslie Mennell) to the invention and ownership of the Oliver filter patents was rejected and nullified by an executive decree promulgated by President Juan Luis Sanfuentes, of Chile. Hence, this ridiculous situation, which was in many ways analogous to the old Moore-Butters litigation in the United States, terminated in much the same manner, and has therefore been eliminated from consideration.

As to the "mysterious attitude of the pampa chemist," this may possibly refer to the semi-annual 'new process' for the treatment of caliche, which is evolved from the inner consciousness of some resident of Santiago or Valparaiso, and is at once caught up by the local newspapers as the long-sought panacea for the nitrate world. I have read the specifications of several of these and have usually found them to emphasize the non-essentials, or to state that "este aparato tiene que trabajar, forzosamente." Such episodes certainly tend indirectly to cast unfair ridicule upon the unassuming pampa chemists. Since, in many cases, the oficina chemist is treated as little more than a druggist's clerk, and may even combine with his own work that of 'bodeguero' (warehouseman), or even 'practicante,' the wound-swabber and basin-holder for the local doctor, it is unreasonable to expect from such an one, either the fund of available information that a thoroughly trained chemist would bring to research work, or the energetic interest of a well-paid engineer in developing new metallurgical technique.

I am in touch with the present efforts that are being made to improve the operation in nitrate-making, particularly as regards economy in treatment, costs, and extraction, and with one exception these efforts do not limit themselves to the consideration of the use of the equipment of one firm alone, as is intimated by your correspondent. Modern metallurgical plans and machinery are being tried in various places, and whenever a device promises utility it is being tested, either at one plant, or at another, of the progressive organizations. From all these efforts a general fund of data will accumulate, and thereby, doubtless, the cost of producing Chilean nitrate will be lowered considerably, but the export tax imposed by the Chilean government, amounting to 28d., plus some 60% of super-charge per quintal of nitrate shipped, is a great clog on efforts to achieve cheap production. However, that is mixed with considerations foreign to questions of technology.

DONALD F. IRVIN.

Antofagasta, Chile, May 30.

Locating Metalliferous Lodes Containing Alunite

The Editor:

Sir—Referring to the interesting question in the letter by J. F. Law, together with your comment, in your issue of June 22, I beg to ask whether the interpretation which you give does not indicate the possibility of some unpleasant conflict of interests? For example, if a man should locate a claim under the old law in order to possess himself of metalliferous deposits, might not another party, realizing the existence of potash minerals in the vein, which the original locator had failed to claim under the special potash law, demand from the Department of the Interior a prospector's license covering the same ground? If, then, he should demonstrate the existence of valuable potash minerals in the vein, would the Department not be obliged to issue a lease to him, resulting in the unique situation of two sets of owners having rights in the same mine with respect to different substances? Furthermore, if a man should locate a gold mine

that happened to lie adjacent to a pegmatite dike containing high-grade orthoclase, assaying 10% or more in potash, might not the innocent gold-miner be interfered with seriously by some one else undertaking to locate the contiguous dike within his claim? It seems to me that Congress must have overlooked the fact that potash minerals are likely to be found associated with metalliferous lodes, even constituting part of the gangue of such lodes.

The possibility of bringing about such an embarrassing situation as this for the sake of establishing enough of a right to potash to admit of harrassing lode miners with the peril of litigation would seem to make it important for owners of lode mines to investigate their deposits to ascertain whether potash minerals were present, and, if found, to protect themselves by applying for a lease under the potash law.

ALKALI.

Goldfield, July 1.

War Minerals Bill

The Editor:

Sir—I am enclosing a copy of a letter I sent to Senator Walsh of Montana this week. If you think proper you may publish it. I might add that my interest in the War Minerals Bill is not because of a desire to control or to regulate the mining interests, for they are doing all in their power, but to co-ordinate the work, so as to prepare to meet deficiencies and, where necessary, to adjust the difficulties of small companies and to aid them. England and France have found this necessary. Why do we not profit by their experience?

Hon. T. J. Walsh,
Washington, D. C.
My dear Senator Walsh:

Replying to your kind letter of May 7, I would advise you that I was in Washington from May 13 to 16 and attended two of the Senate committee hearings on the War Minerals Bill. I was fortunate in hearing the testimony of D. G. Kerr, vice-president of the United States Steel Corporation. I hesitate to comment too freely on this and other matters lest my remarks may be interpreted as adverse criticism, whereas in reality my interest is constructive and is to urge legislation that will co-ordinate the work coming under this head, thus enabling the producers, the consumers, and the Government to work together with complete understanding, and in a way that will meet the demands of the War for greatly increased production. Witnesses have stated to your committee that there is already sufficient special law to do the things necessary to increase mineral production and to protect and encourage it. In any case this legislation is scattered and not uniformly interpreted. Different departments must be consulted and must authorize different proceedings. Red tape must be overcome; authority and centralization must be provided to give quick action and to execute a far-seeing plan for providing necessary materials. This will be accomplished by the War Minerals Bill. It is the principal reason for this bill. As to details, I believe these have been well threshed out in the House and before the Senate committee. I will ask for your special consideration of one or two items.

There are many small properties owned by men of little or no means that are necessary to the Country at this time if production is to be assured. Who is going to finance them? The big companies have not done so as yet, and in any case they have enough to do to get out their production. Besides they are not miners. The financiers and the banks cannot or will not because prices are far above normal and are not guaranteed for a sufficient time to assure them the return of their money, and also for the further reason that their profits are limited by the Excess Profits Tax Law. The establishing of a price for sixty or ninety days does not protect a War Industry that it may take six months or a year to develop, equip, and bring to a producing state. Most of the best and largest mines that can make money under normal conditions are now in operation. Their production is insufficient to meet the needs of the Country. Ships are not available to import the material in sufficient quantities. The Government must provide either laws, guarantees, or prices. It may even in some cases have to operate. Nothing essential to bringing to us a complete victory in this war can be left undone.

With reference to price-fixing it would seem that one fixed price for any product is not just, because large rich mines would gain profits, which cannot always be guarded against or recovered through excess-profit taxation. A 'cost-plus' is likewise objectionable because it leads to extravagance. It has not proved uniformly successful in shipbuilding. I can only suggest a 'zoning system', combined with a graduated scale based on the size and richness of the property, and on operating and transportation charges from the mine to the market. This would correspond to a preferential such as has been given to small coal mines. Governmental operation should be authorized in the case of urgently needed materials, but only as a last expedient when a mine is closed because of litigation; when the owner refuses to work the property; or when it is owned by an alien enemy or doubt exists as to whether the ownership is truly American, that is, owned by naturalized citizens born in enemy countries.

I shall be glad if you will bring these matters before the Committee with the further comment that the measure will assure the needs of the Country and be popular if the administrator selected is a man with long practical experience and training in mining as well as business—such men for example as B. B. Thayer and Pope Yeatman.

GEORGE WARREN TOWER, JR.

New Rochelle, New York, May 29.

ACETIC ACID PRICES have not been fixed, but by agreement the quotation is 15¾c. for 100% as the basic price, and 19c. for glacial acetic. These are based on acetate of lime at 4 cents.

Expansion of Metals by Heat

By JOHN ROGER

The expansion of metals by heat is usually given as the percentage of elongation that takes place when samples of the different metals of equal lengths are raised in temperature an equal number of degrees, for instance, from 500 to 501°F., thus establishing a co-efficient of linear expansion. When the expansion is given volumetrically, that is, by equal volumes of the dissimilar metals, the relations of the co-efficients are considered to be the same, that is, the metal is supposed to expand equally in all directions, the volumetric expansion being the linear expansion multiplied by three. The irregularity of these co-efficients for different metals has led to much discussion as to the cause when the great irregularity observed is not due to the peculiar behavior of the metals but to the way in which the co-efficients have been determined. The figures given by different experimenters lack uniformity, so that only approximate relationships can be shown, but they are near enough for present purposes.

It must be evident that if the temperature of one cubic foot of nickel is raised 1° F. with a specific heat of 59.97, and the temperature of 1 cu. ft. of lead is raised 1° F. with a specific heat of 21.97, and the relative expansions are compared, the comparison does not involve two things that are equal or proportionate. Almost three times as much energy has been added to the nickel as to the lead, and it should be clear that co-efficients determined in this way must lead to confusion. To get the proper relationship in the expansion equal units of energy must be added to each. If the co-efficient of expansion, as determined by equal units of temperature, is divided by the volumetric specific heat we will get co-efficients by equal units of energy, and these will be found to be, in a general way, inversely proportionate to the force of atomic attraction, as indicated by the number of degrees between normal (the temperature at which the specific heat was taken, say 500° absolute) and the fusion temperature for each metal. The co-efficients of expansion would seem to increase as the metal gets softer, but the figures are not regular enough to admit of saying that this is actually so.

they are no doubt far from being correct. The column 'Co-efficients of expansion by equal units of temperature' is supposed to be the co-efficients per cubic foot of metal, in each case raised in temperature from 500° to 501°, that is, raised 1°, which for nickel would give $59.97 \times 778 = 46{,}356$ ft.-lb., while for lead it would represent $21.97 \times 778 = 17{,}062$ ft.-lb. of energy, and for the other metals an amount proportionate to their specific heats. The column 'Co-efficients of expansion by equal units of energy,' gives the co-efficients by temperature divided by the specific heat in each case, which gives the expansion of one cubic foot of each of the metals, due to the absorption of 778 ft.-lb. of energy, and these co-efficients, as will be seen, are in a general way, inversely as the force of cohesion, as indicated by the melting temperatures, or just what might naturally be expected.

The confusion as to the expansion of metals by heat may be said to come from three things: first, from estimating the specific heat of metals by gravimetric proportion; second, from failure to differentiate between heat and temperature; and, third, from the contemplation of latent heat, something which does not really exist.

GOVERNMENT STANDARDS FOR ELECTRO-PLATING have been fixed at a conference of military authorities with representative members of the plating industry, officials of the American Electro-platers' Society and members of the Bureau of Standards staff. It was decided that zinc-plating is the most efficient method of preventing corrosion of iron and steel. No specifications are necessary for materials not subject to severe corrosion, but black finishes should be specified as 'black nickel,' and copper-sulphide finishes eliminated. The Preece test, the NaOH test, and $SbCl_3$ tests, are the most efficient for testing zinc-plated products. The NaCl spray test is advised until a more suitable one is found. The current unit test is adopted for determining the thickness of zinc to be deposited to withstand the test. For surfaces of separate units, the minimum amount of zinc should be deposited that will withstand the corrosion-test. As a basis, the weight deposited should approximate 50 mg. per sq. in. (6.45 sq. cm.) of surface. Occlusion of H from pickling and plating solutions containing free acids cause crystallization of high-carbon steel, so the wet method of tumbling, together with the use of an abrasive

Co-efficients of Expansion of Metals

Metal	Specific heat per lb.	Weight per cu. ft. lb.	Specific heat per cu. ft.	Co-efficients of expansion by equal units of temperature	Co-efficients of expansion by equal units of energy	Tensile strength per sq. in., lb.	Temperature to melt above 500 deg.	Melting temperature absolute, deg.
Platinum	0.032	1,347	43.10	0.0000144	0.000000334	50,000	3160	3660
Nickel	0.109	548	59.97	0.0000208	0.000000347	80,000	3060	3560
Iron	0.113	480	55.58	0.0000197	0.000000354	60,000	2760	3260
Copper	0.095	552	52.44	0.0000266	0.000000507	34,000	1890	2390
Gold	0.032	1,200	38.40	0.0000236	0.000000613	20,000	1932	2432
Silver	0.057	655	37.33	0.0000324	0.000000867	36,000	1710	2210
Aluminum	0.214	167	35.10	0.0000369	0.000001051	20,000	1175	1675
Zinc	0.095	436	41.42	0.0000422	0.000001018	6,000	740	1240
Tin	0.056	458	25.64	0.0000349	0.000001357	5,000	402	902
Lead	0.031	709	21.97	0.0000471	0.000002143	3,000	585	1085
Antimony	0.051	421	21.42	0.0000388	0.000001811	1,000	770	1270

In preparing the above table the figures have been taken from the best sources of information available, but with an alkaline soda solution is suggested. Zinc-plated steel is protected by paraffin and paraffin oil.

SCENE ON THE TRANS-SIBERIAN RAILROAD

Conditions in Russia

By FEDOR F. FOSS

*To understand events in a large country like Russia it is important to know what this country represents; what are the chief characteristics of the people and the general economic conditions.

I would remind you that the total area of Russia was over 8,500,000 square miles, with a population of 181,000,000 people. The United States has 3,500,000 square miles and 100,000,000 people. Two-thirds of the whole population are Russian Slavs, divided into Great Russians 66%, Little Russians 26%, and White Russians 7%, besides 8,000,000 Poles and other Slav branches. Then come the representatives of the Indo-European group; Letts, Livonians, Gmuds, numbering 3,000,000. The Western European races include Germans, Swedes, Norwegians, English, Danes, and Dutch, in all about 2,000,000. The Roman family is represented by 1,500,000 Rumanians, French, and Italians. The Semitic race, besides Jews, includes Syro-Chaldeans and Arabs. The Ural-Altai people are represented by 3,500,000 Finns and 14,000,000 Tatars. The religions practised in Russia are many. The principal ones are the Greek Catholic about 70%, the Roman Catholic 9%, Mohammedans 11%, Jews 4%, Protestants and Evangelists 5%. From these figures you can see that Russia is not a nation but a gigantic conglomeration of races, religions, and languages.

The first question that arises is, how could such a nation have so long been a strong military power, and how could such an empire collapse so easily?

Russia was created by the Great Russians. This race, even at an early stage of development, showed constructive force. In the past centuries there have been just two ideas that in the minds of the peasants have stood for the State; they were the Czar and the Church. During the feudal period the Czar was the sole sovereign, the supreme judge, with the power of life and death over all. You will remember that in Russia feudalism ended not so very long ago. The peasant of earlier days neither saw nor comprehended the complex connections between political, social, and economic forces; to him the Czar was not only monarch in the social and political domain, but in order to explain the life and activities of nature, he accepted him as the personification of Providence.

The psychology of the lower class is simple. A Russian must see and touch a thing in order to appreciate and understand it. The men who created the Orthodox Church in Russia realized this phase of the Slav mind; hence that religion is founded on the worship of God through the pictures of Christ, the Holy Virgin, and the Saints. The direct conception of an abstract idea is foreign to the mind of the peasant. Therefore the Church provides an innumerable list of saints whose pictures or ikons are the media through which the peasant mind approaches the Deity. Similarly, to the peasant, the idea of the State was expressed by the person of the Czar and by the institution of the Church. The pictures of the Czar used to be as common as the ikons; they exercised the same function in relation to the Government as the religious pictures did toward the Church. In short, the Czar and the Church were the keystones in the arch of government. In a day, when the country was entirely unprepared for such a change, the Czar ceased to exist and the Church was eliminated. To the

*An address delivered before the Engineers Club, San Francisco, on July 2, 1918.

common people, the State seemed to have disappeared. They have never had a national idea save in terms of Church and Czar, and when both were removed their minds lapsed into pitiful confusion. The masses did not in the least realize the significance of what had taken place, there being no strong educated class to guide them.

The division of the Russian population into classes does not mean much. We have the following divisions: Peasants, burgesses, non-Slav citizens, Cossacks, clergy, honorary citizens, and nobles. The peasants constitute about 77% and the burgesses about 11%; but for our purposes it is better to say that we have two classes, one educated, and the other illiterate. A very small portion of the latter has been through the primary schools, but within a few years they have forgotten what they learned, because they had no use for learning. The average percentage of illiteracy in Russia is 79. The average literacy for both sexes is 21%. It is 29% for men, 13% for women. Of course, in some towns we have a higher percentage of literacy, up to 79, 55, and 33% in some Western cities. These two classes, as I said above, one more or less educated and the other wholly uneducated, have never been welded together. Russia has had no class that understood the vital necessity of industrial development.

For a large group among the educated people we have a special term, the 'intelligencia.' These persons have been brought up on all kinds of philosophies and social ideas, with an inclination to "save the world," to "assist the unfortunate," and generally to improve conditions by talking. They have tried to make the peasants feel that they are unfortunate and oppressed, and that they must demand their rights. Such suggestions, combined with the tyranny of an autocratic government, and without the development of the productive forces of the nation, created dissatisfied talkers who did not know their own wants. The intelligencia has been deprived of all elementary rights and, oppressed by the autocracy, it had no ability to create an organizing and productive class.

The conditions of Russian life before the War can be described in the words of Gregor Alexinsky: "Contradictions abound in all spheres of Russian life. In the economic domain we see modern capitalism developing itself with American celerity, alongside medieval villages whose economy is still almost natural. In the social domain the proletariat, in part conscious and organized, eager to procure the triumph of the ideal of universal happiness, and trained in the ideas of a theoretical socialism, live side by side with the feudal 'seigneurs' who do not recognize even the most elementary demands of justice. In the political domain the most sincere and ardent aspirations toward liberty contend against the worst possible methods of repression. And in the literary and artistic domain, while many Russians are known far beyond the frontiers of their country for the novel simplicity and profundity of their thought, 120,000,000 inhabitants of Russian soil are absolutely illiterate. The youth of the intellectual and working classes are materialistic atheists, but the most barbarous prejudices, the most primitive fetishisms, constitute the mentality of the Russian peasant. On the one hand is an arrogant aristocracy, incessantly feasting in stone-built capitals. On the other hand are millions of human beings sheltered under straw roofs and nourished by black bread."

I would mention that some prominent statesmen of Russia have many times put forth the idea that it is better to leave the peasants in entire ignorance than to give them only a little education; they insisted that a small amount of education produces discontent and socialistic ideas without compensating advantages. Therefore these statesmen have hampered educational development. I can make a comparison of the Russian intelligencia, thoroughly educated but not practical and partly idealistic, to a thin layer on an ocean of ignorance. While the ocean was quiet, the intelligencia floated safely, but when the ocean became stormy, the layer was suddenly broken up into many pieces and was driven back and forth on the restless waves without any organization, sense, or ability to do anything.

The contrasts of Russia are caused by the clash of modern European, or if you will, Universal ideas, and the remains of the Middle Ages, the heritage of the period when Russia still lived her own life and was not yet drawn into that mill of the world which crushes between its mighty stones the grain of humanity to make the bread of the future.

Before the beginning of the world-war Russia was the largest civilized empire in the world, a Colossus, but with legs of clay. The foundation of government lacked two elements, education and economics. Now I shall turn to detailed figures in order better to illustrate the internal life of Russia. The density of population varies greatly and is comparatively sparse. It averages 10 inhabitants to the square kilometre. The densest population is 114 in the province of Moscow, 104 in Kiev, whereas the least density is 0.4 in Yenesei. Of the total population 13% is in the towns and 87% is rural.

In comparison with other civilized countries Russia is first in the number of inhabitants and in having the smallest average per square mile. In 1912, out of 1063 towns and urban settlements with a population exceeding 10,000 (the number of urban settlements is 182), only 219 had an organized water-supply, that is, 20% of the total. Of the remaining 204 towns only 167 provide water to private houses. In 52 urban settlements the inhabitants have to fetch water from central reservoirs. There are settlements with a population exceeding 100,000 that have no water-supply. Only 59 systems with extensions to houses have filters. Only 40 towns have canalization or sewerage. The refuse is carted to some distance from the town in the majority of municipalities, but a few towns have special space reserved for the purpose. In 61 cases the refuse is washed by high-water, in 24 by ground-water, and in 5 by both. In 492 cases all refuse is thrown into the sea, rivers, and ditches, or not removed at all.

In the whole of Russia, out of 1231 towns 1068 have

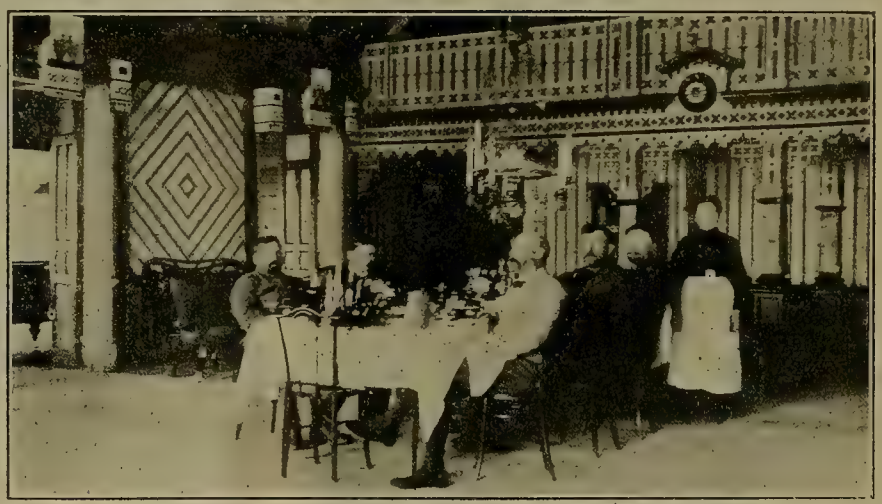
public lighting; of these, 162 are lighted by electricity, 128 by gas, 1028 by kerosene; 1047 towns have slaughter-houses, 1136 have fire-brigades, 54 have tramways, 32 have telegraphic service, and 314 have telephones. There are 902 towns with public libraries and reading-rooms (the United States has 18,000 libraries), 76 towns publish 919 periodicals, 178 towns publish 576 newspapers (the largest circulation being about 200,000 per day). The United States has more than 22,000 periodicals. About 510 towns have printing-presses, 124 have typo-lithographic establishments. There are 136 towns with museums.

LUNCH COUNTER ON THE TRANS-SIBERIAN RAILROAD

According to the last census, the contagious cases and infectious diseases average 19,500,000 per annum, this being 12% of the total population. The proportion of diseases was as follows:

	%
Itch	22
Malaria	18
Influenza	15.5
Syphilis	6.5
Typhus	3.3
Trachoma	5
Dysentery	4.3

This indicates the lack of hygiene and rudimentary sanitation. We had about 22,000 doctors, including 1750 women. In European Russia there is one doctor for 1300 people in the towns and one for 21,900 in villages. In Asiatic Russia is one doctor for 2800 townspeople and one for 37,600 villagers. The number of beds in hospitals has been about 220,000. During the War it has been enormously increased. Of every 1000 infants 267 die before they are a year old. The birth rate is 45 per 1000.



HEADQUARTERS OF THE VESSENNIJ MINE. THE DINING-HALL.

PASSENGERS EMBARKING ON A RIVER STEAMER

The following figures show the state of education: Russia has 52 superior schools, together with 135,000 middle and primary schools with 9,000,000 scholars, of which 82% attended elementary schools, 26% secondary schools, 3% special ele-

mentary and secondary schools, and 20.8% had the higher education. The remaining 7% attended private schools. The annual expenditure during recent years has been 150 million rubles, or $70,000,000. So as to make the comparison easier I shall remind you that you have in the United States about 270,000 elementary schools, and that your school and college enrollment is 22,480,000, with 700,000 teachers and an annual expenditure of over $800,000,000.

The relative importance of the different occupations in Russia is as follows: Rural 77%, manufacturing and other industries 10%, private and personal services 4.5%, trade and commerce 3.8%, transportation 1%, mining 0.4%, professions connected with public needs 0.7%, government and public service 0.6%. In the United States agriculture takes 35.7%, manufacturing and industry 24.4%, commerce, trade, and transportation 16.4%, and personal services 19.2%.

In order to outline the conditions of economic life of Russia I shall mention that of the total production of Russia (which we reckon at 20 billion rubles), more than half is agriculture. The land question is the basic question for Russia. The country has a tremendous area suitable for agriculture, forming one-third of the total surface in European Russia, something around a billion acres. Moreover, there are large arable areas in Siberia and Middle Asia. Of this land 39% is owned by the Government, 36% belongs to peasants, and 25% to other private owners. Five-sixths of all the peasant-owned land is communal, that is, a community uses the arable land, the woods, the meadows, and water-supply in common.

About 270,000 acres are sown with cereals, potatoes, and fodder-grass. As to crops, I need only mention that the largest output of cereals in Russia is rye, 35 million tons; wheat, 24 million tons; oats, 13.5 million tons; barley, 10 million tons; and potatoes, 27 million tons. If we compare Russia with the United States according to the relative area under cultivation, we find that in the United States it constitutes 10% of the total land, whereas in Russia it constitutes but 5%. Taken with reference to the population of the two countries, we find that to each inhabitant of the United States there are about 2½ acres of cultivated land, while in Russia there are only 1½ acres. The prevalent method of agriculture in Russia is the three-crop system. Russia has a low average yield of cereals per acre, averaging 10 bushels for wheat against 15 to 18 in the United States, 17 in Rumania, 20 in Germany, 30 in Sweden, 34 in England, and 44 in Denmark. At the same time the expenditure per acre for soil improvement in Russia is the smallest. In Norway it is $1, in Prussia 67c., in Sweden 25c., in the United States 21c., and in Russia 5c. per acre. On account of faulty methods of fertilization, the lack of irrigation, and the primitive implements employed, the peasant's economy is completely dependent upon natural conditions, or, as they say, upon God. In mining and metallurgy Russia, despite her vast resources, is far behind the United States, the first producer of metals in the world.

	Russia, tons	United States, tons
Coal	40,000,000	585,000,000
Pig-iron	4,500,000	60,000,000
Copper	40,000	1,000,000

The production of lead and zinc, silver and tungsten, has been merely started; only in platinum do we lead the world, producing 95% of the total output.

In the consumption of all staples Russia is at the bottom in comparison with other nations, thus:

	Russia, lb. per head	United States, lb. per head
Coffee	0.14	11.0
Tea	0.91	1.1
Sugar	0.5	1.5
Pig-iron	50.0	1,100.0
Coal	440.0	11,700.0

The consumption of copper, lead, and spelter is even on a smaller scale, so I need not mention these figures.

The hunger for land on the part of the Russian peasantry has been interpreted by Russian socialists as an indication that the peasants are natural socialists. This idea was supported by the fact that, as I have mentioned before, five-sixths of them hold their land in common. But this conclusion is absolutely wrong, because the Russian peasant is a socialist only up to the moment when his land-hunger is satisfied and he becomes a private land-owner. After he gets the land and tills it, he will not allow any socialist to take the land from him, nor will he try socialistic experiments with it himself. In confirmation of this idea it may be stated that in seven years, after the enactment of a law permitting the peasants to go out of their communities and settle on the isolated farm-lands, 5,000,000 peasants settled upon 86 million acres. In order to show how rapidly the peasants applied for land, it is interesting to mention the following figures:

Applied in	Households
1907	219,000
1908	380,000
1909	704,000
1910	650,000
1911	678,000
1912	1,226,000
1913	1,105,000
	7,598,000

All this shows that Russia affords a big field for development. She has one of the largest systems of railroads in Europe, about 50,000 miles, but when you make a calculation per square mile of per head of population, the figures are small. They represent 1 kilometre per 100 sq. km. of area in European Russia and 0.07 km. per 100 sq. km. in Asia. For 10,000 inhabitants, it represents 4 kilometres in European Russia, and 5.8 km. in Asiatic Russia. In the United States the figures are 4.3 km. per 100 sq. km. and 42 km. per 10,000 population.

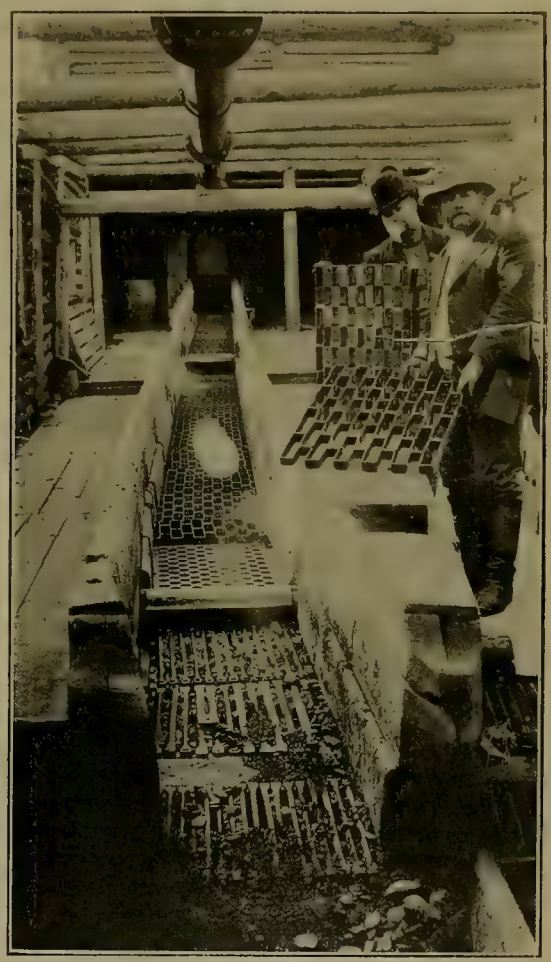
It will be seen from these figures that, despite the fact that Russia was an old empire, she was quite a young country from the standpoint of development, from the first necessaries up to the edcuation of the people. She dreamed of freedom, but she was oppressed by the autocracy. She was poor and undeveloped, with practically no industries, but with faith in her future. And when the Hun started his drive for world-conquest, this same Russia promptly mobilized eight million soldiers of the very best quality, who started a brave offensive against the Germans and Austrians. When these

half-educated people saw that the German was a treacherous enemy, killing the wounded and torturing the prisoners, the Russian soldiers were fired with resolution, and made a marvelous campaign in East Prussia and in the Carpathians, taking more than 1,500,000 Austrian and German prisoners. Through the shortsightedness and stupidity of the Government the soldiers did not have enough munitions and implements; they fought bare-handed and yielded only when they had nothing but sticks to oppose to rifles. By this campaign

ON THE VITTIM RIVER. THE CAPTAIN, TWO SCHOOL-GIRLS, AND ANDREW NISBET

Russia saved France and Europe, and gave to England time to prepare her army. In three years Russia has mobilized 16,000,000 men and has lost 7,000,000 in casualties and sickness.

The Russians, after having got freedom so easily—for the power of the autocracy fell as quickly and as easily as a rotten apple falls from the tree in a light breeze—accepted the promise of the socialists and the German spies that they would at once receive peace, land, and prosperity if they would lay down their arms. Though they had suffered so much from German cruelty during the War, nevertheless they believed that there was no use in further fighting, that all people are brothers, that the War was a device of emperors and capitalists to gain power and money from the common people. The poor peasants, with their eye on the land, thought that if they could have plenty of it they would not need to fight Germany, and that Germany would make peace at once if they practised the principle of non-annexation and no indemnities. While the new-born Russian free citizen talked continually about the principles of universal happiness, the German agents were doing their destructive work. They succeeded in disorganizing the Russian army by introducing so-called democracy into the army, namely, the election of officers. The result of this propaganda is well known. The Russian army of more than 12,000,000 men disappeared as snow before the rising



THE RIFFLES USED AT THE VISSENNIJ GOLD MINE

sun of Russian liberty. Most of the officers were killed, and instead of the army came an armed mob, which, under the guidance of extremists, idealists, and German agents, is ruling Russia now.

The Russian soldier, lacking education, especially political education, without any knowledge of statecraft, readily accepted the simple idea suggested by the Germans and the Bolsheviki: "Why fight and face death when you now have full liberty? Go back to your homes, take possession of the land and divide the wealth of the capitalists, who are the enemies of the oppressed peasants." "And go back quickly," warned the propagandist, "because if you come too late, all the land will be divided among the people and you will be left out." In

the first month the number of desertions from the Russian army was increased by 2,000,000 men.

I often hear the question, "Where are the Russian intelligent classes? Why don't they help Russia to recover herself?" You know the answer now. The proportion of intelligent people is small, scattered, and now for the most part killed. The Russian intelligencia is paralyzed, and, being under the suspicion of starting a revolution against the Bolsheviki, the small number still alive is deprived of arms and of any means of starting a counter-revolution. Even the banks are seized by the mob in order not to allow somebody to get money to start a drive against the Bolsheviki. Russia is like a wealthy house where lived a large family. The house is attacked by burglars and the head of the family is killed. What can the housewife and the small children do against these burglars when they have no means of defending themselves, and when the natural protector is killed? Would you accuse the children of approving the work of the burglars? No. In the same way the Russian people, when even the delegates of the peasants to the Constitutional Assembly were driven out at the point of the bayonet by the Bolsheviki, went back to their homes, not being able to organize. They are awaiting events. From the outside it would seem that the Bolsheviki are ruling Russia with the consent of the Russian people, but the Bolsheviki acquired control of Russia in the same way in which a small boy with a whip acquires control of a large bull with a ring in its nose.

Mankind should be thankful to the Russian people for what has happened, because at Russia's expense and suffering there has been made on a large scale an experiment in socialism that proves the extreme danger of introducing it under unfavorable conditions. The results of this experiment will save the rest of the world from similar experiments and similar sufferings. It seems to me that the conditions in Russia are already helping the American people to be more united and to win the War before undertaking to settle social problems.

And now what to do for Russia? There is only one answer: Help her. This help must be both practical and sentimental, economic and moral. It is quite clear to everybody who knows the Russian resources and the German ability to penetrate a country, that so long as the Allies permit Germany to stand with one foot on the Russian border, the victories of the Western front will be incomplete. You will have to twist the tail of the German in order to get relief on the Western front.

From our side, American help will show to the world that might is not right, and that, as we say, "God is not in force, but in the truth."

ASPHALT manufactured from domestic petroleum during 1917 amounted to 701,809 tons, valued at $7,734,691. Of this, California produced 220,294 tons of solid asphalt from 14 refineries, and 85,134 tons of liquid products. Asphalt from Mexican sources totaled 645,613 tons, worth $7,441,813. Imports were 187,886 tons, and exports 30,107 tons.

Preservation of Pit-Timber

In view of the importance of preventing wastage in pit-timber, the British Department of Scientific and Industrial Research has issued a bulletin in which Percy Groom suggests preventive and remedial measures against decay. He points out that the fungi, which are for the most part responsible for the decay, often clothe the surface of the wood with a fluffy or cotton-like material (spawn) which rapidly spreads, and also produces fructifications that emit spores which, conveyed through the air, may alight on and attack other wood. Colliery timbermen should be taught to recognize the spawn and fructifications, and, starting from the intake, and traveling with the air currents to the return ways, they should periodically inspect the timber. Every fructification should be removed by cutting away the portion of wood to which it is attached, and should then be placed in a pail, carried to the surface, and burnt. For dealing with the spawn the men should carry a swab, cloths, and a pail containing an antiseptic solution; the antiseptics suggested, in order of preference, are creosote and its various derivatives, zinc chloride, and copper sulphate, though the last should not be used where the mine-water is rich in iron. All the accessible wood should be washed with the solution, and the spawn removed. In this way the growth of spawn over the surface would be checked and its transference to other parts of the mine prevented. Preventive methods depend on rendering the wood immune to infection by fungi, through coating or impregnating it with the antiseptic.

ZIRCONIUM minerals are used chiefly as refractory material, which melts only at an extremely high temperature and is very resistant to the action of fluxes and slags. Zirconium fire-brick—made of a combination of zirconium oxide with a proper binder—promises to be extensively used. The fused oxide of zirconium expands so little on being heated that crucibles, muffles, combustion tubes, and similar articles made of it are not broken by sudden changes of temperature. Several alloys of zirconium have unusual properties. A zirconium steel is said to be particularly suited for making armor-plate, armor-piercing projectiles, and bullet-proof metal; a new patented alloy of zirconium with nickel, called cooperite, is extremely hard and is particularly well adapted for making cutting tools. Zirconium compounds are used also as incandescent material, as an opacifier in enamels, and in making paint and abrasives.

LITHOPHONE is now selling at 7½c. per pound, this price to rule until September. The manufacturers of lithophone experience difficulty in obtaining deliveries of crude barytes from mines in the Southern States. Domestic off-color barytes now command $22 to $24 per ton, and pure white floated $32 to $36.

ASBESTOS of domestic origin sold in 1917 amounted to 1683 tons, valued at $506,056, an increase of 13%.

The Ruth Flotation Machine

By ARTHUR J. HOSKIN

Machinery for concentrating minerals by oil flotation is of many designs. New schemes come to the attention of the public frequently. Every method is aimed to take advantage of the phenomena observed by each particular investigator.

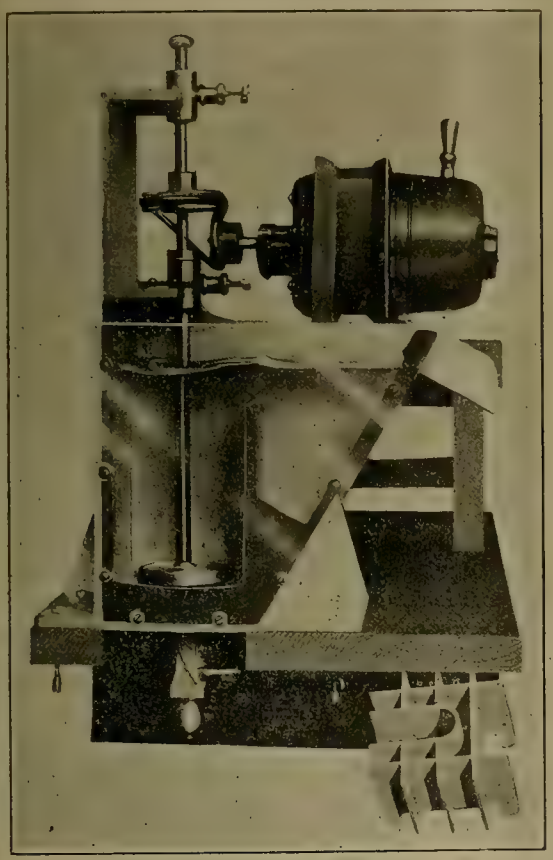
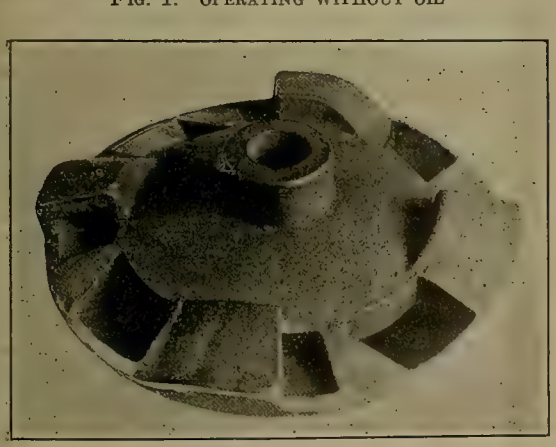


FIG. 1. OPERATING WITHOUT OIL



TOP VIEW OF AIR DISTRIBUTER

Oil flotation is not one process, but several. It is difficult to explain to a layman just what is meant by flotation. There are so many schemes, each founded upon a different principle or theory, that the flotation of minerals has become the work of technical specialists. After pioneers in this technical field had spent years in study,

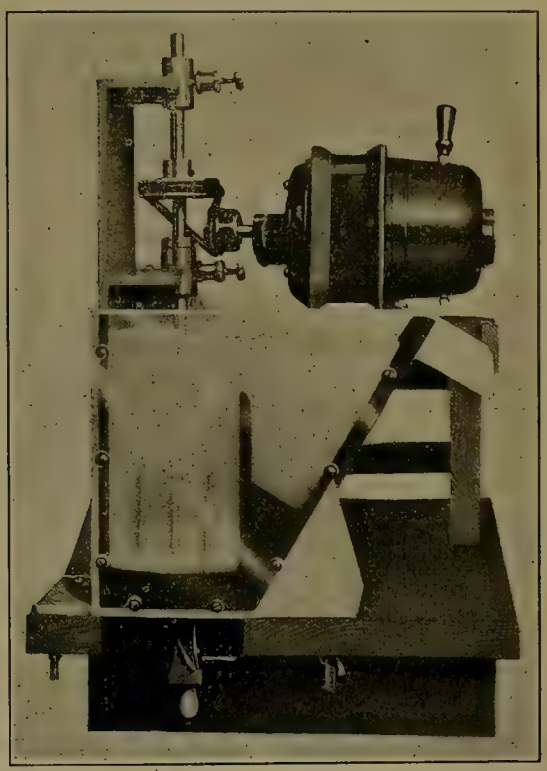


FIG. 2. OPERATING WITH SMALL AMOUNT OF OIL

development, and litigation, a student at the Colorado School of Mines, who had previously worked in mills, became so intensely interested in the process that he decided to make it his specialty. He equipped a private laboratory for research and he proved certain principles he had formulated. Finally he set about to design a machine to apply these principles commercially. This refers to Joseph P. Ruth Jr., of Denver.

The Ruth flotation machine was not put upon the market until its efficiency had been thoroughly demonstrated by long laboratory experimentation. Its inventor designed and built it to accomplish specific things.

He did not announce his findings immediately, but waited until he had proved, beyond all doubt, his ability to duplicate results with all the common sulphide ores upon a large scale. His experimental machine was constructed with transparent plate-glass sides that permitted him to closely observe phenomena occurring under varying conditions. He was rewarded by finding that his apparatus would carry out his theories. It remained for him to modify his machine so as to simplify its manufacture and render it thoroughly substantial under hard operating conditions.

Experimenting with the small laboratory device known as a bubble-tester, Mr. Ruth noted the familiar phenomenon of the adhesion of sulphide particles to bubbles of air. If a bubble be brought into contact with a stationary particle of the mineral submerged in pure water, the latter will affix itself thereto. Oil does not apparently enter into this attraction. The experiment is not a new one, by any means, but it had much to do with Ruth's further research. He next added tiny amounts of soluble oil to the water and found the same adherence of the mineral to the bubble—with this difference: the greater the proportion of oil dissolved in the water, the smaller the mineral particles that would adhere to the bubbles.

All his experiments up to this point were performed with stationary bubbles and minerals. He analyzed the actions of the various flotation machines then in use and took note of the fact that, almost without exception, flotation practices called for the agitation of minerals and bubbles so that there was considerable relative motion between them. The next step was to experiment again and to secure comparative results when both these elements are in motion relatively, when either one is at rest and when both move at the same speed in the same direction. The experiments demonstrated that the mutual attraction between bubbles and sulphide minerals remains constant under the varying conditions, but that the best attachment of the minerals to the bubbles takes place when there is the least amount of relative motion. This finding is in strict harmony with physical laws.

Another line of investigation covered the effect of varying the size and the number of bubbles. The result was simply the verification of the perfectly obvious surmise that the greater the number of bubbles in a unit volume of pulp, the less chance there is for a particle of mineral to escape attachment. A corollary to this is that there should be the greatest possible diffusion of the bubbles throughout the pulp.

Working along the lines suggested by such conclusions, Mr. Ruth devised an apparatus intended to accomplish two things, namely, to thoroughly aerate the pulp and to secure a minimum relative motion between bubbles and mineral particles. To attain these ends he hit upon two exceedingly simple devices. The chamber in his machine corresponding to the agitation compartment in other machines of this same general type (see illustration) is of uniform cross-section so that the pulp is a column ascending at a constant speed, the particles of ore and the bubbles rising at practically the same speed, thus securing the highest approximation to no relative motion between the two important sets of factors. The portion of his machine that takes the place of the agitator in a Minerals Separation unit is known as the 'gas-distributer.' Its purpose is neither to agitate nor to stir. It is a single casting in the form of a closed type of impeller. Air enters the machine through the hollow vertical shaft from above and is discharged through four hooded ports arranged upon the upper surface of this distributer. Simultaneously the pulp is drawn into the distributer from below and, passing through compartments wholly separate from those conducting the air, is discharged through four ports spaced between the air ports. The distributer, revolving at 270 r.p.m., causes an intimate association of the pulp and air as they emerge from the impeller and start traveling upward. This method of throwing the bubbles and the minerals upward simultaneously and at the same velocity obviates all countercurrents, with the consequence that the air-bubbles have an ideal opportunity to become loaded with mineral particles.

During his investigations, Ruth reached a conclusion that stands at variance with the beliefs held by the majority of flotation experts. This conclusion is that the use of oil in flotation has no bearing upon the wetting of the mineral particles, but that the prime function of oil is to so influence the physical consistence of the water as to cause it to become more thoroughly diffused with air-bubbles. He demonstrates this phenomenon with a small machine fitted with transparent plate-glass sides. If this be filled with pure clear water and the distributer be started, the water immediately becomes charged with bubbles of fairly large size, all rising in step with the water. A drop of oil is then added; as soon as it has time to dissolve and to begin issuing from the distributer, the water turns milky white, owing to the increase from relatively few large bubbles of air to millions of small ones. The photographs (Fig. 1 and 2) show this laboratory machine running at the same speed, and mixing precisely the same volumes of air during both phases of the experiment. Mr. Ruth states that any substance, whether it be common salt or any other chemical, that will cause a similar diminution in the size of the bubbles will work equally as well as oil in flotation.

The physics of this effect has not been satisfactorily explained. Ruth asserts that all oils are more or less soluble in water, some being wholly soluble while others dissolve to a very limited degree. It is the soluble portion of any oil, he believes, that indirectly causes the collection of the concentrate. This idea differs radically from the one generally accepted, but it seems proved by this simple experiment. If ore be fed to the machine after stable conditions have become established with a small amount of oil in the water, there does not appear to be any change in the number of bubbles per unit of pulp volume. Agitation tends to increase the solubility of any oil. There is a fixed proportion beyond which the amount of oil dissolved in the water becomes inefficient. The selection of an oil, then, depends primarily upon the type of machine used and the violence of agitation of the

pulp. With the Ruth machine, it is believed that all ores may be treated with equally efficient results if that particular oil be selected that will reduce the bubbles sufficiently in diameter without unduly oiling the water. Again, the gurden of ground ore in the pulp makes no difference in the number nor size of the bubbles. The bubbles should not be too minute or they will not be able to buoy the mineral particles that may become attached. If the slime can be caused to segregate into small masses by this sort of coagulation, these small masses will then be acted upon by the bubble precisely as though they were simple mineral particles and they will be floated and collected with the froth.

Success in treating any given ore in this machine dedepends primarily upon the use of an oil that will cause thorough aeration of the pulp and that will, simultaneously, give reasonable persistence to the bubbles after they rise to the surface and until they are skimmed. The least amount of oil that will make the water milky is just as effective as any greater amount. In fact, Mr. Ruth finds that the richer his liquid is in oil, the smaller the mineral particles that may be promptly floated. He therefore advocates a minimum amount of oil in the first cells—wherein it is desirable to collect the coarsest concentrate—and the addition of oil in succeeding cells to collect the slimy particles.

The accompanying drawings show the construction of the machine. Each cell has an aeration compartment and a settling-compartment or spitzkasten. The complete machine usually contains six such cells.

An automatic and uniform water-level is maintained throughout the machine by gates in the partitions between the aeration compartments, one lever adjusting all gates simultaneously to the same area of opening and thus regulating the forward travel of pulp. The discharge opening—at the end of the last cell—adjusts the height of pulp in all the cells. There are no pipes, valves, or floats.

The aeration compartment is of uniform cross-section from the bottom up to the lip of the overflow partition. A curved metal plate along the back of the compartment gently deflects the pulp-column toward the settling-chamber without modifying the velocity of the column. The froth is removed from the front of the machine by paddle-wheels. Launders may be arranged to retain a separate concentrate from each cell or to blend the six concentrates in any desired combinations.

The commodious passage from the bottom of the settling compartment back to the foot of the distributer affords free and rapid circulation of the pulp. It is claimed this machine will not clog if it be shut down for any reason in the midst of a run, no matter how long the delay. The large passage-way for the pulp combined with the powerful suction of the distributer soon clears the lower part of the machine of any compacted pulp. The distributer, which is less than 13 inches in diameter, ordinarily runs, as stated, at about 270 r.p.m. and consumes less than one horse-power.

The Ruth machine is not of the agitation type, such as those of the Minerals Separation or Janney, nor is it of the pneumatic type, as exemplified in the Callow cell. Its claims for patent were so distinct as to be promptly allowed. The patent, No. 1,268,630, issued June 4, 1918.

This machine was given its first working trial in the Newton mill at Idaho Springs, Colorado, where it was installed to handle the tailing from older units of concentrating machinery. It proved effective in recovering quantities of minerals that had previously run to waste. Unfortunately, from our point of view, the Newton is a custom-mill that treats ores upon a tonnage basis, the clients being satisfied without requiring assays of the tailing and, in consequence, no records of efficiency have been kept. In the Phoenix works, at Denver, a six-cell machine has been running several months on low-grade molybdenite ore from Pitkin; it has made a clean concentrate and a clean tailing.

Cost of Mining Supplies in Mexico

During 1917 the Amparo Mining Co. at Etzatlan, State of Jalisco, treated 84,277 tons of silver-gold ore. The following comparative statement will give some idea as to the general increase in cost of supplies, in United States currency:

Article	1912	1917
Dynamite, case	$9.90	$17.80
Cyanide, pound	0.18	0.88
Mining steel, pound	0.11	0.28
Fuse, thousand feet	3.93	7.95
Caps, hundred	0.46	1.74
Carbide, pound	0.06	0.07
White iron, pound	0.005	0.03
Coke, ton	20.00	70.50
Lumber, thousand feet	40.00	120.00
Nails, pound	0.07	0.18
Round and flat iron, pound	0.04	0.14
Cruciform steel, pound	0.11	0.30
Steel plates, pound	0.06	0.19
Steel shafting, pound	0.08	0.16
Crucibles, No. 300, each	21.00	64.88
Battery shoes, each	10.00	27.00
Battery dies, each	8.00	17.50

A Consular Report dated April 16 at Tunis, northern Africa, gives the following statistics of ore production in Tunisia during 1917: There was extracted 41,400 tons of lead, 15,000 tons of zinc, 606,000 tons of iron, 5800 tons of manganese, 1,000,000 tons of phosphate rock, and 32,700 tons of lignite, representing a value at the quay of over 67,000,000 francs ($13,400,000). These excellent yields would have been better if the phosphate mines had not been hindered by difficulties of exportation.

Zinc-ore producers of the Komspelter region have been trying to increase the consumption of spelter by substituting it for other metals. It was hoped that the Standard Oil Co. would be able to make gasoline cans of sheet zinc, but it was found that zinc could not be soldered by machinery. A new soldering fluid has been devised to overcome this difficulty.

The Menace to Gold Mining

The gold miners of the world are of one accord in demanding that means be found for relief from the hardships entailed by the excessive cost of labor and supplies. The movement is by no means confined to the United States. On July 4 a meeting of leading gold-producers of the British Empire was held in London, on which occasion it was recommended that the Government should arbitrarily increase the price to be paid for the metal. The same idea has been advanced in this country. Sir Lionel Phillips, chairman of the Central Mining Corporation, ascribed the shrinkage in the output of gold to the inability of the mine-owners to meet the increased cost by a compensating adjustment of the selling price. This view conceives that gold is a mere commodity, and takes no account of its position as the standard of reference for the values of other articles of commerce. The American Mining Congress has offered several suggestions, including the exemption of the industry from taxation, the remission of freights on the supplies needed, exemption of the employees from the draft, and the payment of a bonus. The California Metal Producers' Association has endorsed the plan for paying a bonus, proposing $10 per ounce as the minimum, in addition to the regular rate of $20.67. It is claimed that a bonus of $10 would re-establish the earning power of the mines on about the same level as that existing before the War. Another suggestion made by the American Mining Congress was to remove the embargo upon the exportation of bullion so far as related to new gold produced in this country, in order to admit of taking advantage of any opportunity to dispose of it abroad at a premium. This ignores the primary object of accumulating a larger reserve in the United States as a basis for expanding credits, in consideration of which the Secretary of the Treasury has been insistent that gold must be treated as a war-essential. His letter to Mr. Sulzer, which has been widely copied, was based on the importance of augmenting our stock of gold in order to make it easier to sustain the obligations of the Government. Unless a large reserve is available serious difficulties may arise as the bonds and notes of the Treasury become multiplied.

Commenting upon the importance of gold as the foundation of finance, Hennen Jennings testified, at a hearing before the Committee on Ways and Means of the House of Representatives, with reference to the new revenue bill: "I have been connected, in different capacities, with gold mining—between 30 and 40 years—in California, Venezuela, South Africa, England, and Montana, and have examined mines in Mexico and Alaska, and am conversant with difficulties and cost of producing gold. I have given much time and thought to the article on 'The gold industry and gold standard,' which I believe contains much that is pertinent to your inquiry and which I beg to put in evidence.* My aim is to show that the gold industry differs from all other industries in that it is impossible for it to obtain any excess profit during this war period; but, on the contrary, it is proportionately burdened as the price of other commodities used in its obtainment advance, and as long as the integrity of the gold standard is maintained by this and other countries. The advantages of upholding the gold standard should and do rest with the countries that produce the most gold and hold the greatest reserves. We hold the greatest reserves. Great Britain and her colonies and dependencies produce 62.6% of the gold of the world; the United States, second, with 19.3%, while within the territories of the Central Powers less than 1% is mined. The production of the gold of the world was at about a standstill for some years before the War. It is now on the down-grade. Our Liberty bonds are pledges in gold. How can they be redeemed, or faith and belief in them kept up, if gold outputs are allowed to dwindle, while the bonds multiply manyfold? Gold is no mere luxury; it is a necessity for the credit and financial unity and strength to the Allied countries. It is thus vital that gold mining should be encouraged as far possible and burdened as little. Gold mining has more or less pioneered the other mines of the world, and the modernness of mining can be appreciated by the statement that the output of gold during the last 18 or 20 years, of copper in 15 years, of petroleum in 11 years, have equaled all that was produced since 1800; and probably the output of mines in the last 20 or 30 years of the world of all the fundamental minerals—that is to say, iron, coal, copper, petroleum—has been greater than in all history. This has resulted in the great modern activity of industry, because mining has produced the requirements and the raw materials that have aided man to manufacture force. It has been a power for the service of man equal to between two and three billion men's muscular work. I make this little preface to show you the part that gold and mining generally have played in the industrial world. I have already spoken of the gold output of the warring nations. The greatest goldfield of the world at the present time is the Witwatersrand in South Africa. . . . Although this goldfield has cheap labor, and coal in proximity, the dividends from the producing mines do not amount to over 22% of the whole output.† Therefore the margin of profit is not so very great. From the statistics of gold production in the United States for the years 1914, 1915, 1916, and 1917, it will be seen that the

*This article appeared in our issue of May 11, 1918.

†In 1917 the output was worth £38,323,921, and the dividends £6,718,604.

bulk of the output has not come from the phenomenally rich mines, but from those of moderate yield and comparatively low grade, such as the Homestake and the Alaska Treadwell mines.

The inquiry in Committee, following Mr. Jennings' preliminary statement, is reproduced in part:

MR. RAINEY: What is it that gives gold its money-value? The fact that it is valuable in the arts, the fact that it is valuable as jewelry, and desirable on those accounts has given it its value from almost the beginning of time, hasn't it?

MR. JENNINGS: That gives it its stress value.

MR. RAINEY: It has been always the precious metal of the world?

MR. JENNINGS: Yes, sir.

MR. RAINEY: How much is an ounce of it worth?

MR. JENNINGS: $20 and a fraction. I have forgotten.

MR. RAINEY: Now, certainly in the world there has developed a precious metal [iridium], valuable in the arts, more valuable in the arts than gold, more valuable than gold or any other metal in chemistry, which is worth per ounce, we will say, eight or nine times as much as gold. Is not that metal now the precious metal of the world?

MR. JENNINGS: It is more precious; yes, sir.

MR. RAINEY: Do you know what the value of iridium is now?

MR. JENNINGS: No; it changes so rapidly.

MR. RAINEY: It can't change in this country any more, because we have placed a value on iridium of $170 an ounce.

MR. JENNINGS: Iridium is found in connection with platinum. That is worth $105 an ounce.

MR. RAINEY: We have just placed $105 the value per ounce on platinum.

MR. JENNINGS: Yes, sir.

MR. RAINEY: Do you know what the value of palladium is per ounce?

MR. JENNINGS: No, sir.

MR. RAINEY: We have just placed a value of $130 an ounce on that. They are worth more than gold now. They are the most precious metals in the world. We can't fight wars without them. They are used in so many ways that that gives them, inasmuch as this is a world war, a still added value. I want to present this question to you for consideration. I don't know whether you will be able to answer it now, but you will be in the record. Germany controlled nearly all the world's supply of platinum, palladium, and iridium until 1901, and until the War broke out she was the controller of the American supply, which came from the Ural mountains, and so on until the outbreak of this war. It doesn't exist any more. Russia produced 80% of these metals, which are the most precious metals in the world, and Germany controls the supply in the Ural mountains. If, after the War is over, Germany should still continue to be a large manufacturing country and still retain control of these three precious metals and should monopolize these metals—one of which is worth over nine times as much as gold, what effect would it have upon the gold standard in the world?

MR. JENNINGS: In the first place, I don't think simply the preciousness of gold makes its utility as a standard. Over-preciousness would make it impracticable, and over-preciousness is the trouble with platinum and iridium. There isn't enough to act as trading counters.

MR. RAINEY: The Russians have never developed the Ural mountain supply as the Germans will develop it?

MR. JENNINGS: No; it is a very small amount in quantity compared to the output of gold throughout the world. The universality of gold shows that it is appreciated as to its reasonableness, and in this table it is shown that gold is mined in 60 different countries. Therefore, its universality and its not over-preciousness is in its favor.

MR. RAINEY: It has always been the most precious metal in the world until the last two or three years?

MR. JENNINGS: No; platinum has always kept even with gold—at least, as a rule.

MR. RAINEY: But we never realized its value as we do now.

MR. JENNINGS: We need it for special purposes, I grant you, but it isn't simply precious.

MR. RAINEY: Do you know about the world's supply of platinum—the world's stores of platinum?

MR. JENNINGS: My memory is not clear on that. It is comparatively a small number of ounces. I shouldn't think it would amount to—I don't like to guess, but it is very small compared to gold. I can get you an accurate figure from the Bureau any time you like, but I have an idea somewhere in the neighborhood of 100,000 ounces.

MR. SLOAN: Platinum became valuable largely when electricity and lighting came into vogue, did it not?

MR. JENNINGS: Yes; it has been used for a good many purposes. We are using it in the production also of nitrogen.

MR. SLOAN: For the last half-century platinum has run almost parallel with gold—its value?

MR. JENNINGS: Yes, sir.

MR. SLOAN: But this is true, in urging its use for a good many purposes. It don't burnish like gold, it is not as desirable for the vision as gold, and it yields to certain acids (anything that has lead in it), so that it may be lost in a very short time?

MR. JENNINGS: It is really more valuable in the arts now for electrical purposes, and chemical purposes, and in laboratories—and it is very useful.

MR. SLOAN: It has an element of preciousness in not being in quantity enough to make it bulky.

MR. JENNINGS: Yes, sir. I have tried to make the point that the basis of money is faith; there is no reality to money beyond an inducement to workers to produce; the production of the worker. Gold has, by its very history, extending over so many years, and being regarded as the counter of value by the human race, has inbred a belief in its value. It has been supported in that belief very curiously by almost the constant diffi-

culty of attainment that nature has demanded for her gold, efforts from man equivalent to the value man has placed upon gold as a trading-counter. Therefore its great reality is the basis of work of hand and brain to get it. You just read some of our prospectuses of sanguine gold miners, and you would think that gold would flood the world, but it hasn't.

MR. SLOAN: Do you know any important section of the globe where the existence of gold has been excluded by careful research?

MR. JENNINGS: No, sir; I do not at the moment.

MR. SLOAN: It is found in every State in the Union, is it not?

MR. JENNINGS: In small quantities. Platinum, unfortunately, we produce but very little of it. We save some platinum in connection with our dredging operations in California. It is obtained in cleaning up the gold, but I think it is but a very small per cent. Among other places where it is found is Colombia, in South America, and it is more encouraging there than any place outside Russia. Russia, as has been stated, is the great supplier of platinum.

MR. SLOAN: Yes; in the Ural mountains, but the very limited bounds of production or area of platinum would exclude it being a standard for the world, wouldn't it?

MR. JENNINGS: Yes, sir.

MR. SLOAN: And its value would also exclude its feasibility of being handled.

MR. JENNINGS: Yes, sir.

MR. SLOAN: And it must have some weight—some general indestructible weight, and pass in the laboratory. Platinum will stand more heat. It will yield to the fumes quicker than gold. Isn't that true?

MR. JENNINGS: Yes; it is quite indestructible as a whole.

MR. SLOAN: Yes; I quite agree with you about its general indestructibility.

MR. RAINEY: The world's production of gold in 1916, from your interesting compilation, amounts to $457,000,000.

MR. JENNINGS: Yes.

MR. RAINEY: The world's production of platinum, 89,000 ounces.

MR. JENNINGS: Eighty-nine is it?

MR. RAINEY: Yes; 89,000 ounces. At the present value of platinum that would be worth nearly $100,000,000.

MR. JENNINGS: Yes.

MR. RAINEY: Therefore before the War, that is, on the basis of 1916 output, and the present platinum value, the value of gold mined in the world is only four times the value of platinum mined in the world, so the difference isn't so great after all in value.

MR. JENNINGS: You say 100,000 ounces.

MR. RAINEY: No; roughly it is worth $100,000,000 at the present time.

MR. JENNINGS: Isn't it $10,000,000?

MR. RAINEY: The world's production of platinum is about 90,000 ounces.

MR. JENNINGS: It is $10,000,000, I think.

MR. RAINEY: I am just guessing at this.

MR. JENNINGS: Figures are getting so colossal these days it would be very easy to get them wrong. I think I am prepared to come to the point you wish me to come to, as to the taxation of gold.

MR. RAINEY: Yes; it is about $10,000,000. I was mistaken.

MR. OLDFIELD: How much with respect to the curtailment of production do you estimate the present tax of the law?

MR. JENNINGS: It is very difficult what to say. There are so many factors in it. It depends on the locality.

MR. OLDFIELD: Would that be involved in placer mines?

MR. JENNINGS: Yes, sir; in all classes of mines. Some of them are just on the verge of profit, and some of them are making liberal profits. So gold mining, no matter how rich it is, as I hope I have shown, can't make an excess profit during this war. It must make a loss during the period compared to what existed before the War, and that is the reverse of most any other commodity. I think there is this difference: If we could do, which is a very difficult matter, you want to raise revenue, and I appreciate that, but you also want to get the maximum amount for your revenue you raise. If under present conditions, the real standard is the difficulty of obtaining gold, and we are having inflation of values which the governor (which is a governor) is not sensitive but takes time to adjust, it will in the end lower issues of gold $2 certificates where we ought to be issuing them for $1 for prices that existed before the War. And as we get back that lower price, so automatically will the gold mines be encouraged to go on. They will be shriveled up and stopped if the price is advanced beyond certain limits. If prices go up that way, we are pledging our credit unnecessarily. If we could bring lower prices in certificates and gold—I think it is not only a simple matter of one or two gold corporations, but it is a matter of great public concern demanding the thought of our best financiers—this gold production and gold standard.

MR. RAINEY: And if gold is valuable on account of its preciousness and value, it occurs to me that iridium, palladium, and platinum might make a desirable monetary metal after the War on account of its value and scarcity; and if iridium is worth nine times as much as gold, if Germany should make gold a secondary metal, as we used to have silver the secondary metal, the ratio would only be then about 1 to 9 in order to make platinum the precious metal and give gold the ratio of silver we used to have when it was 16 to 1. So I think the question is worthy of your consideration to make a study of the standards.

MR. JENNINGS: Yes, I will look into the question further. But it isn't simply the question of preciousness of gold that I am urging at all. For instance, if you want simply the preciousness of material we have diamonds which per weight is so much more precious

than iridium, and yet you wouldn't think of diamonds as a standard.

MR. RAINEY: It wouldn't be desirable as a medium of exchange because of the difficulty of handling and coining it.

MR. JENNINGS: Yes. What we want is a medium of exchange. The great usefulness of gold exchange seems to me is that it is understood in so many different parts of the world, and the difficulty of obtainment is big, and it is taken in one country and another on the basis of weight and purity, owing to the certificate of coinage, simply on the weight and purity; but its ductility makes it easy of coinage. It is much easier to coin than platinum. The difficulty of platinum is it would not be as easy to coin as gold and it has a great many qualities of appealing to mankind as a counter of exchange that has taken place so many hundreds of years. Of course, I think we cannot ignore that the precedents of history have given a preference to gold."

The above colloquy reveals an indeterminate state of the legislative mind regarding the gold standard and regarding the general principle of a monetary standard. The disposition to consider a change in the measure of value because we are suffering from top-heavy credits as nations at war have suffered in the past, is surprising. To question the standard of exchange at such a period is to unsettle finance and invite commercial chaos; it resembles the proverbial error of attempting to swap horses while crossing a stream.

The conditions in British Columbia are as severe as in the United States, as shown by the report of the Minister of Mines for 1917, the production of gold having steadily declined within the past three years. The comparative figures are as follows:

	Placers		Lode-mines	
	Ounces	Value	Ounces	Value
1915	38,500	$770,000	250,000	$5,167,934
1916	29,021	580,500	221,932	4,587,334
1917	24,800	496,000	114,523	2,367,190

In view of the closing of the Rossland mines, and of the fear that many gold properties in the Province may be forced to suspend operations, the Minister of Mines has approved the recommendations of the Northwest Mining Association, at its recent meeting at Spokane, Washington. The resolutions adopted there were the following:

"That all war taxes be remitted in-so-far as they affect gold mining.

"That the present advance in freight rates be abrogated in respect to the gold mines that are unable to operate at a profit under the present rates.

"That commercially inaccessible gold properties of merit be made accessible through the building of motor roads.

"That the gold-mining industry be placed on the same basis as other war industries in respect to financial assistance, to be extended through the War Finance Corporation or by means of re-discounts through the Federal Reserve Bank, or through any other means that may be devised.

"That operators of gold properties be given a government guaranty, instead of a bonus, which guaranty shall assure to gold-mine operators profits commensurate with those that would have accrued to them under the pre-War conditions and prices of labor, supplies, taxes, and other items of general expense.

"That any and all acts of the Government directed to the financial aid of the gold-mining industry, as above set forth, shall be subject to the examinations, reports, and recommendations of properly qualified mining and accounting experts acting on behalf of the Government.

"That copies of these resolutions be forwarded to Secretary McAdoo and to the senators and representatives of the various mining States."

In California the stress under which the gold miners are operating is greater than in many other parts of the world, owing to the low grade of the ore. In the Grass Valley district the average recovery is about $7 per ton, which is far above the average for the State. In the Mother Lode counties it is only $4.19, and these mines produce 46% of the total output of California. During the first six months of 1917 the Californian gold production amounted to 89,830.307 oz., and during the corresponding period of the present year it has declined to 66,668.039 oz. One large dredge at Carrville, Trinity county, built two years ago at a cost of $400,000, has been obliged to cease operating, and other dredges will soon stop working. The difficulties in California are aggravated by the regulations of the Debris Commission for the impounding of tailing by dams, which are costly to build and maintain. Some modifications of these requirements are deemed advisable under the existing circumstances. The hydro-electric power companies have also shown a disposition to restrict the use of current in gold mining, owing to the large demand at higher rates from other industries. The mining companies pay 0.8c. per kw-h., while power for commercial purposes sells at 1.2c. The total power-distribution for 1917 amounted to 584,225,935 kw-h., for which the average rate paid was 1.859c., and the anticipated consumption for 1918 is 642,648,529 kw-h., for which an average return of 1.797c. per kw-h. is expected. It is comprehensible that the power companies would prefer to serve the customers that pay a higher rate, but if gold mining should be declared definitely and unequivocally to be an essential industry no discrimination could be made, and the rates established by the State Railroad Commission would apply. The interest displayed by the Secretary of the Treasury in the production of gold undoubtedly will lead to action by the War Industries Board to place the gold mines on the priority list, and legislation by Congress in aid of the industry is to be expected.

IRON-ORE SHIPMENTS from the Lake Superior region during June totaled 9,921,860 tons, an increase of 281,869 tons when compared with that month of last year. Shipments to July 1 in 1918 and 1917 were 18,949,730 and 16,135,135 tons, respectively. This movement took place through the Sault Ste. Marie lock and canal, which passes the largest tonnage of any waterway in the world.

Magnetic Properties of Manganese and Special Manganese Steels

An elaborate study of this subject was made by Robert Hadfield, C. Cheneveau, and Ch. Geneau and published recently in the Proceedings of the Royal Society of London. To find the connection between the magnetic susceptibility per unit mass (called the mass susceptibility) of different manganese steels and their chemical constitution, measurements were made with the help of the magnetic balance of P. Curie and C. Cheneveau. In this instrument the body to be tested is attached to one arm of a torsion balance and is brought into a stronger and stronger field of a horse-shoe magnet moved horizontally at right angles to the line joining the poles. The observed deflection of the torsion balance increases at first, then diminishes. If the magnet be moved still farther, a deflection in the opposite direction is observed, which again passes through a maximum at the point where the variation of the field of force is greatest. The difference between the readings of the torsion balance when the deflections are greatest on either side is proportional to the mass susceptibility, so that this quantity can be determined by comparison with a specimen whose susceptibility is known. All specimens were enclosed in glass tubes of different shapes, generally with very thin walls. They gave an inappreciable deflection in the most intense magnetic fields, even when the balance was at its greatest sensibility, that is, when the platinum wire was the thinnest procurable. The use of this glass, the search for which entailed great trouble, was exceedingly advantageous; it did away with the necessity for correcting for the magnetic effect of the envelope. The standard adopted for comparison was anhydrous $CoSO_4$, for which $X = +58 \times 10^{-6}$ at 20°. For pure powdered manganese prepared from manganese amalgam $Y = 11.0 \times 10^{-6}$ at 18°. Manganese is paramagnetic, whatever its condition. The ferro-magnetic properties which it possesses after being melted or deposited by electrolysis are without doubt due to occluded H_2. The presence of occluded gases should not be neglected when examining the magnetic properties of metals or alloys prepared by melting. The mass susceptibility of special manganese alloys, which varies between -17 and -259×10^{-6}, is independent of the magnetic field, and these alloys are paramagnetic. For manganese steels X is only slightly influenced by the amount of manganese present, but depends considerably upon the carbon content and generally increases as the ratio C/Mn diminishes. If the ratio is constant the addition of other metals always increases X. An increase of nickel from 2.57 to 19% increases X in the ratio of 23:67. An increase of 0.74% tungsten increases X in the ratio of 18:29. An increase of 3.5% chromium raises it 10%. For copper, in spite of its diamagnetism, 2.25% in a Mn-Ni steel raises X by about 19%. All of these steels were quenched in water from 1050° and were all of the paramagnetic austenitic type. The addition of 6% silicon to a manganese steel where C/Mn = 0.01 makes the steel much more ferro-magnetic. A secular change in the magnetic properties of this steel has also been observed, the specific magnetism increasing, in a period of several years, from the order of 4 or 5% of that of pure iron up to nearly 50%.

Determination of tungstic acid in wolframite is the subject of a paper by Luis Gugliamelli and Ulaus Hordh, in the 'Anales de la Sociedad Quimica de Argentina.' Inconsistent and unsatisfactory results were obtained with various methods for the detection of tungsten in wolframite. The precipitation method originally described by Treadwell (precipitation of tungstic acid with HNO_3) is not quantitative for this purpose, and is subject to losses of 8 to 10% or more; the filtrate from this precipitation was always found to contain an appreciable amount of tungsten, the color reaction being due to the formation of lower blue oxides by the action of nascent H from HCl and Zn. The method more recently described by Treadwell, that is, the fusion of the mineral with Na_2CO_3, extraction with hot H_2O, and treatment with concentrated HCl, failed to give better results. The same was true of the Berzelius method by fusion with alkali and final precipitation with $HgNO_3$. Incomplete precipitation of tungstic acid by treatment with a mineral acid (HNO_3 or HCl) is due to silicic acid, which is always present in wolframite; this reacts with the tungstic acid to form soluble silico-tungstic complexes which are only slightly hydrolyzed by acids under the conditions of analysis and are not destroyed by repeated evaporation with HNO_3 nor even by heating to 130° C. The Berzelius method is also inaccurate because the mercury salt of the silico-tungstic acid formed is rather soluble in warm, slightly acidulated H_2O. The G. von Knorre method was employed in the following manner, and was found to give satisfactory results. The mineral was decomposed by fusion with Na_2CO_3, the aqueous solution obtained therefrom was neutralized with HCl (methyl orange indicator), 10 cc. tenth normal H_2SO_4 was added and the tungstic acid was precipitated at the ordinary temperature by an addition of an excess of benzidine-HCl solution; SiO_2 (after ignition) was eliminated by evaporation with H_2SO_4 and HF. The filtrate was free from tungsten. Satisfactory results were obtained when the method was applied to pure, crystallized sodium tungstate and tungstic acid. All of the above methods are satisfactory for the analysis of compounds, such as pure sodium tungstate. The G. von Knorre method alone is recommended for detection of tungstic acid in minerals such as wolframite and scheelite, which contain silicic acid. This method has the following advantages: The formation of the silico-tungstic complex at ordinary temperatures is practically nil and consequently the amount of SiO_2 so obtained is so insignificant as to require no separation in most cases; the formation of the silico-tungstic complex has no appreciable influence on the separation of tungstic acid, and the precipitation of benzidine silico-tungstic is quantitative; and after incineration the SiO_2 present, from decomposition of the silico-tungstate, may be eliminated readily and the total content of WO_3 may thus be obtained.

REVIEW OF MINING

LEADVILLE, COLORADO

Manganese Developments.—Railroad to be Torn Up.

M. L. Buchanan and associates, who have formed one of the largest combinations of manganese producers in the district, have added to their former holdings by securing a lease on the A. V. shaft in California gulch, near the south end of Harrison avenue. A short period of development, in which the surface plant was repaired, the shaft re-timbered to a depth of 400 ft. and prospecting carried ahead on the 400-ft. level, has resulted in the discovery of a large body of ore assaying 35% Mn. Five carloads have been shipped to various Eastern markets as trial lots. An air-compressor and drills are now being installed, and the output will soon be increased greatly.

The manager of the Dold Mining Co., C. J. Dold, has just returned from Denver, where he purchased equipment for the Newell shaft, which will be re-opened. The shaft will be equipped with a steam-hoist, motor-driven compressor, and drills. A large reserve of high-grade manganese is now exposed in the property. A good deal is being extracted from the Northern.

Lessees at the Hibschle shaft, south-east of the Northern, recently found a deposit of iron and manganese, carrying 8 oz. silver per ton. Ore is being shipped regularly to the Colorado & Ohio plant at Salida.

At the Chrysolite property on Fryer hill, lessees have opened a body of silver-iron ore assaying 46% iron and 5 oz. silver. An output of 20 tons daily is being maintained, and preparations are being made to double this output. A new standard-gauge siding is to be constructed to the property this month.

The decision just reached by A. E. Carleton, president of the Colorado Midland Railroad, who was recently appointed receiver for the line by Judge J. W. Sheafor of Colorado Springs, to junk the 250 miles of trackage and all equipment, is regarded with considerable anxiety in Leadville. Much of the switching to the mines is being done by the Midland, whose lines extend to many of the properties along California gulch and on Rock hill. It has also, in connection with the Colorado & Southern, handled the ores from the Penrose and Bohn properties in the Down Town area. Just what the result of closing the road will be has not been fully estimated, but it will undoubtedly work a great hardship on a number of local operators.

REVELSTOKE, BRITISH COLUMBIA

Northwest Mining Convention Meeting: Prospecting, Geology, Taxation, and the Smelter Dispute.

The annual Northwest International Mining Convention which was attended by delegates from Washington, Idaho, and Montana, as well as the Provinces of Alberta and British Columbia, was held at Revelstoke on July 8, 9, 10, and 11. It was one of the most important assemblages of its kind when the attendance, the high standard of addresses, and the general discussion are considered. The enthusiasm was sincere, and the citizens of Revelstoke furnished the visitors splendid entertainment. One of the features of the opening session was the occupancy of the chair by Mrs. Ralph Smith, the first woman member of the legislature of British Columbia, and the first of her sex to preside over the deliberations of such an organization.

Alex. McRae was chairman of the executive committee in charge. The remainder of the personnel was: W. J. Coulthard, vice-chairman; F. B. Hill, secretary; L. A. Howson, assistant-secretary; K. G. McRae, treasurer; with W. A. Anstie, H. McKinnon, B. R. Atkins, A. Johnson, W. R. Grubbe, M. H. Lister, and W. A. Sutherland, the last being

MAP OF BRITISH COLUMBIA, SHOWING MINERAL AREAS

the member of the legislature for Revelstoke. A mineral exhibit was on view, consisting of specimens from practically every known British Columbian mining centre; while the Consolidated Mining & Smelting Co. contributed a special display of the products of its Trail smelter. T. O. Bibb was in charge of the exhibit.

A. G. Langley, Provincial resident mining engineer for the Revelstoke district, gave the first address, the subject being 'Discovery and Development of Prospects.' He said that the district had been prospected for gold, silver, lead, and other minerals to some extent, but there was much to be accomplished. He reviewed mining activity from the 'eighties in the Big Bend, Trout Lake, Ainsworth, and other centres. Emphasis was laid on the importance, when good ore was found, of thoroughly prospecting the adjacent ground. Valuable hints were given to aid the finding of ores peculiar to the Kootenay region.

Bruce White, of Sandon, chairman of the Western Section of the Canadian Mining Institute, discussed 'Geology and Mineral Resources of the Revelstoke District.' Declaring

that there were more geological formations in this part than in any other of British Columbia, he said that even tin was found in pegmatite rock on the headquarters of McDougall creek. This pegmatite was an altered granite and quartz mixture and was of the pre-Cambrian age. Tungsten was likely to be found in this vicinity or might be associated with the tin in the form of scheelite. In the Trout Lake district manganese-iron was identified; while molybdenite was found in several places along the Arrow lakes, in the altered-granite formation. Little work had been done on them. The Big Bend country, north of Revelstoke, had been well known for over 50 years, its placer mining having first brought it into prominence. The speaker referred briefly to the Trout Lake and Lardeau district and its mineral riches, and concluded by expressing the opinion that the Revelstoke district possibilities were not realized, and that all that was necessary to bring about valuable results were men and capital.

The Hon. John Hart, Minister of Finance, took for his text 'Taxation, as it Affects the Mining Industry.' He reviewed the taxing of mines from 1896 to the present time, and concluded by saying that "it was hardly necessary for him to repeat that the Government is determined that taxation shall not interfere with the progress of mining in this Province.

R. Randolph Bruce, of the Paradise mine, Windermere, followed with an acknowledgment of the courtesy and consideration given the representatives of the mining industry by the Government in discussions on taxation.

On July 10, S. G. Blaylock, of Trail, assistant general manager for the Consolidated Mining & Smelting Co., gave an interesting address on 'The Part Played in the War by the Trail Smelter.' He spoke of the development of the lead and other departments of the smelter since the outbreak of war, and stated that facilities had been provided for reducing all the ores of the Province.

A. B. Clabon, president of the Vancouver Chamber of Mines, took for his subject 'The Value of the Mining Industry.' In the afternoon the Hon. W. Sloan, Minister of Mines, delivered a spirited speech entitled 'British Columbia, the Mineral Province.' He traced the development of mining in this Province from 1848, when the Hudson's Bay Co. first mined coal on Vancouver island. Since then, $170,000,000 worth of coal has been dug, also $80,000,000 from lode mines in the last three years. California's mining had produced $37 per capita, while British Columbia yielded $115 per capita. The Government had assisted the prospector. He disapproved of the 2% tax, favoring taxation on the net income of the mines. The Government was encouraging development of the iron-ore resources.

'Northwest Kootenay' was the title of an address by Orville Young, of Golden.

F. A. Starkey, of Nelson, president of the Eastern British Columbia Associated Boards of Trade, addressed the convention on Thursday morning, his subject being 'Closer Co-operation Between Boards of Trade and Mining Organizations.' He regretted the lack of a better understanding between the mine-owners and the Trail smelter.

A prospectors' luncheon was held, nearly 100 delegates parting. This was unique and appetizing, the menu calling for bacon, beans, and bannock.

In the absence of Thomas French, manager for the French Complex Ore Reduction Co., Nelson, his paper on 'Some Notes on the Smelter Situation in British Columbia' was read by F. B. Hill, the convention secretary. A vigorous address, strongly protesting against the evils of the 'smelter trust', was delivered by Sidney Norman, editor of the 'Northwest Mining Truth', and representative on this occasion of the Spokane Chamber of Commerce.

J. J. Warren, of Trail, president of the Consolidated Mining & Smelting Co., whose address was entitled 'Some Smelting Problems Under War-Time Conditions', summed up the difficulties with which the company has had to contend, and warmly defended its management against statements made by some of the speakers. He spoke of the difficulty of finding labor, of the increased cost of production for various reasons—among those cited being coal strikes, which restricted operations—and of the problem of fixing smelting rates. In regard to the latter he instanced the inability of the mine operators to supply the lead demand of the winters of 1916 and 1917, as a result of which an effort had to be made to meet the demand from the American side. When, however, war needs were satisfied, the smelter found itself without a market, and, the lead market having collapsed, the company had a surplus on its hands. Shortage of clean lead ore in British Columbia for smelting purposes was the great difficulty. He resented the suggestion that the company was not treating the mine operators fairly. If it were to be subjected to Government regulation the same action should be taken with saw-mills and flour-mills. The smelter was ready to treat lead at $1 over cost which, he believed, was a better rate than was quoted by any other smelter on the continent.

Charles F. Caldwell, of Nelson, president and manager of the Utica Mines and president of the Kootenay Mine Owners Association, outlined the claims of the mine-owners of the Kootenay district with respect to smelting rates, and asked for the sympathy and support of the convention and the boards of trade of British Columbia.

In closing, the convention considered the following resolution, in addition to passing those of the usual formal character: "That insomuch as the Consolidated Mining & Smelting Co. is treating custom ores and may be considered a public utility, a Royal Commission be appointed to investigate and regulate treatment and smelter charges, guaranteeing fair and equal treatment to all producers." It was decided, on amendment, to defer action pending consideration of the matter by the Associated Boards of Trade.

SAN FRANCISCO, CALIFORNIA

Status of Gold Mining.—Metal Output in 1917.

The State Mineralogist, Fletcher Hamilton, has issued a circular to gold producers, in which he desires particularly definite facts relative to the difficulties encountered due to economic conditions arisen since 1914, as follows.

1. Increased costs of supplies, equipment, etc.; labor; power; and total.

2. Statement as to decreased efficiency of labor and decreased labor supply; also causes for same.

3. Effect on development of ore-reserves; and on prospecting.

4. Ratio of decrease in gross gold production; also in tonnage of ore mined (exact figures would also be helpful).

5. Effect of new taxation.

6. Effect of increased freight rates; of delays (if any) in receiving orders for supplies and equipment.

7. Percentage of decrease in dividends.

The U. S. Geological Survey, through Charles G. Yale, of the local branch, has issued advance figures of mine production of metals in 1917. There was a total of 3,003,250 tons of ore treated, yielding gold worth $20,087,504, 1,775,431 oz. of silver, 48,153,139 lb. of copper, 21,868,628 lb. of lead, and 10,872,716 lb. of zinc, all valued at $37,685,985. The comparative figures for 1916 were $21,410,741, 2,564,354 oz., 55,897,118 lb., 12,407,493 lb., 15,256,485 lb., worth $39,749,263. Lead was the only metal that showed an increase. This nearly all came from San Bernardino county. The Mother Lode in Amador county yielded 804,875 tons of $4.55 gold ore. Nevada county produced 480,869 tons averaging $7.65 per ton.

THE MINING SUMMARY

ALASKA

Iditarod.—In Bulletin 655 (162 pages) of the U. S. Geological Survey, the Lake Clark-Central Kuskokwim region is described by P. S. Smith. Exploration of this region traversed a field almost unknown, therefore its results replace nearly a complete blank in knowledge of the geography and geology of Alaska. Geologic work was hampered by absence of bedrock over wide areas. Few mines or prospects are being developed in the region. Iditarod is

MAP SHOWING SITUATION OF LAKE CLARK—CENTRAL KUSKOKWIM REGION

the nearest active district. Gold placers have been worked at many places adjacent to the area, but only on five creeks in the Lake Clark drainage basin. The only gold lodes being prospected lie north-west of Lake Clark and at Candle creek. Quicksilver has been reported at several places in the Kuskokwim basin. Copper occurs near Iliamna lake and near Lake Clark. Antimony is found with mercury on the Kuskokwim and near Iditarod; none has been developed. Silver-lead ore has been opened south of Iliamna lake; molybdenite in small quantities west of the north end of Lake Clark, and manganese in the same area. Each of the mineral resources is described as far as possible, and may be of service to prospectors and others who might investigate the region.

ARIZONA

Crown King.—This is one of the resurrected districts of Arizona. From the 'seventies to 1915 the mines experienced many ups and downs. In the latter year D. B. Gemmill and M. P. Randolph leased the Crown King mill and started treating the tailing dump. A system of flotation was applied that recovered 1540 tons of zinc concentrate and 1500 tons of iron-gold-silver concentrate, from 12,000 tons of tailing. These products were sent to the smelter at Humboldt. The old mill was overhauled. The Arizona Power Co. extended its lines to the mill, also the Wildflower and Tiger mines. An aerial tram was erected between the former mine and the mill, which at present is dressing 60 tons daily of $12 gold-silver and $3 copper ore. Recovery in 1917 was 91%. The Tiger mill was remodeled. Old tailing has been treated since February 1918, and will not be worked out until September. It carries 12 oz. silver per ton, also some gold. Concentrate assays 200 oz. silver and $8 gold. Recovery is 70%. The Bradshaw Development Co. has certainly made this district 'come back.' Other mines are the Springfield, Lincoln, Swastika, and Nelson.

Globe.—Arizona Commercial pays 50 cents per share on July 31. This is equal to $87,500.

Jerome.—Owing to the labor situation being investigated by the Federal mediator, Hywell Davies, wages here were not advanced 50c. as was done at other Arizonan copper centres. The Central Labor Union has asked for a flat increase of $1.10 per day for all classes. After hearing committees from all sides and investigating the problems put up to him, Mr. Davies went to Los Angeles, where he has been in consultation with Charles W. Clark, general manager for the United Verde Copper Co. It is said that matters affecting the providing of suitable and cheaper places of abode for the employees of the district will be the principal topic taken up at this conference.

Calumet & Jerome is to prospect by drilling on the 600-ft. level. The Diamond Drilling Co. will do 2000 feet.

United Verde Extension is said to have experienced a good deal of trouble in blowing-in its new furnace. Two charges 'froze' last week.

Mayer.—Five miles east of this place is Copper Mountain, where a considerable amount of development is being done. At 500 ft. below the main adit-level in the Copper Queen a wide vein has been found.——The Arizona Binghampton mill is treating 175 tons daily, with high recovery.——The Copper Mountain company's shaft is down 250 ft., and will be deepened to 500 ft.——Rich ore has been opened at shallow depth by the Big Bug Copper Co. Indications point to a probable large deposit.——A 50-ton flotation plant is being erected by the Pocahontas.——There are six new deals pending for well-located properties in this district.

ARKANSAS

Harrison.—The 75-ton mill of the Harrison M. & M. Co. was burned last week. It was under lease to the Continental Mining Co., and will be re-built.

CALIFORNIA

Angels.—The new vein at 3200 ft. in the Utica mine is said to be opening well, assaying $10 per ton.

A considerable quantity of chrome continues to be shipped from deposits in the serpentine belt a few miles east and south-east of Angels.

Coran.—The First National Copper Co., controlling the Balaklala company, will pay a dividend of 15c. per share in

August. This is No. 4, making a total of $570,000. The mine is shipping 200 tons of ore daily to the Mammoth smelter at Kennett. Profits are $17,000 per month.

Engelmine.—The Engels Copper company has built 40 cottages for employees, is erecting 8, and has let a contract for 70 more. The company is looking after the welfare of its employees in a commendable manner. The daily output of concentrate is three carloads.

Grass Valley.—The Allison Ranch mine is being unwatered to the 900-ft. level. Pumps are working at 700 feet.

The North Star company received a new rope weighing 9 tons for its main shaft last week.

Keswick.—The Mountain Copper Co. is shipping 800 tons of ore daily over the railroad from the Iron Mountain and Hornet mines. This is almost normal, notwithstanding the labor shortage, which has caused all development to be suspended. The company's enlarged flotation plant at Minnesota station will be completed in about a month.

Pittsburg.—The Commissioner of Corporations has authorized the National Metals & Chemical Co. to issue 995 shares in exchange for a plant and its equipment to be used for the reduction of ores by the use of mechanical and chemical processes. The company also will extract precious and other metals from ores and manufacture nitric acid by the fixation process.

Redding.—On July 16, 1500 miners, smelter-men, and laborers in the Shasta County copper belt were notified that wages were advanced 50c. per day by the four companies—Mountain Copper, Mammoth Copper, Bully Hill Mines, and Balaklala Copper. The voluntary increase was given by the companies after a conference of the general managers, following the raise in price of copper to 26c. Under the new schedule, miners and machine-men will receive $4.50 for an eight-hour day, and shovelers $4.

An agreement between the California State Highway Commission and the U. S. Department of Agriculture has been signed whereby the Redding-Tower House Federal post road will be started as soon as bids can be secured. This important highway will be built with an expenditure of $105,334 by the Federal government, and approximately a similar sum derived from the sale of State bonds of the $15,000,000 issue. The new road will open up an important mineralized area, with deposits of chrome and other ores.

Winthrop.—The Bully Hill mines are expected to yield 250,000 lb. of copper per month for the remainder of this year. Development on the 900-ft. level of the Star shaft is said to be very good. The first unit of the flotation plant will be ready in September. It is planned to treat the complex ore for zinc, copper, gold, and silver. So far this year—four months—13,646 tons of ore has been treated, yielding 1,623,591 lb. of copper, 2623 oz. of silver, and 449 oz. of gold. Walter Arnstein and associates are operating the group under a bond on which a large payment was made at the beginning of the year. R. L. Beals is general manager.

COLORADO

Boulder.—The Rare Metals Co. at Rollinsville is concentrating tungsten ore carrying as low as 1% WO_3. There is said to be a good deal of this grade in this and the Nederland district.

Cripple Creek.—The Cresson company reports that the Roosevelt drainage-tunnel will be connected with the mine during the next 40 days. An important discovery was recently made in the Cresson drift of the tunnel, when 11 ft. of ore was opened. With the connection of the tunnel, development on the lower workings of the mine will be resumed, as it will clear out the bad air, which has been retarding operations. While there have been substantial discoveries of new ore in the mine, no additions to ore-reserves have been made since April.

Ouray.—The Mountain Top mine in the Sneffles district is producing carloads of ore that return between $5000 and $6000 net. It is said that the farther this property is developed below the zone of rhyolite flows that cap the andesite the richer the silver content of the veins.

Pueblo.—The Princess Annie Copper Mining & Development Co. is driving two tunnels in the Sangro de Christo range, 15 miles south-west of Westcliff. No. 1 tunnel has a vertical depth of 150 ft. on ore, and No. 2 a 350 ft. vertical depth on ore assaying gold 0.8 oz., silver 10 oz., and copper 15%. Ira Severns is general manager.

Rico.—This district has prospects of having a custom mill. Matt. Chestnut, one of the leading local men, and a Denver company, have purchased a mill-site, and plans for the building are under way. Although the ores are low grade, they are excellent for smelting, carrying a large amount of lime in addition to iron. Some of the ore carries zinc, and concentration should produce a high-grade shipping product. The lack of a custom mill has been a serious handicap to development of the district.

Telluride.—Ore and concentrate shipments from this district in June totaled 94 cars, 30 less than a year ago. This does not mean a reduction in output, as the Liberty Bell is reducing everything to bullion instead of sending out concentrate. Water in the Smuggler mine curtailed production.

IDAHO

Mullan.—The Copper King M. & S. Co. has developed a large shoot of lead-silver-copper ore, and contemplates erecting a concentrating plant this summer. L. F. Hayes is superintendent.

Salmon.—The Drilling Development Co., owning a large property on an intrusive porphyry dike on Carmen creek in Lemhi county 13 miles east of Salmon City, will shortly be a gold and silver producer. The company has just arranged a contract with the Koering Cyaniding Process Co. of Salt Lake City for three recovery-drums, equal to 200-ton capacity. The mill includes a roasting plant followed by the Koering system. The three drums will be ready for shipment in 60 days, and it is expected to have the mill operating early in October. Extensive development work has been done and a large tonnage of ore blocked, averaging $7.75 gold and silver per ton, with fairly high zinc content and some lead. The precious metals will be extracted first, and tailing assaying enough zinc will be impounded for further treatment; this also will be by the Koering system. This company has offices at Butte. Guy W. Stapleton and Phil T. Dunn, of Butte, Montana, and C. W. Sherwood, of Salmon, Idaho, are the main owners.

Wallace.—Dividends paid by companies in the Coeur d'Alene during the second quarter of 1918 are as below:

Hercules	$ 750,000
Bunker Hill & Sullivan	490,500
Consolidated Interstate-Callahan	232,495
Hecla	.....
Caledonia	234,450
Federal, (common)	209,757
Tamarack & Custer	106,574
Total	$2,023,776

Tamarack & Custer is earning $50,000 net per month. The mine and mill are operating with full complement of labor.

KANSAS

Galena.—Drilling on 29 tracts in this field shows a deep 'run' of zinc ore, that is, from 179 to 465 ft. depth.

MISSOURI

Granby.—The American Z. L. & S. Co. is building a high smokestack to prevent lead fume from annoying the residents.

Joplin.—Production of the region last week was 7574

tons of blende and 940 tons of lead. These averaged $56 and $97 per ton, respectively. The total value was $514,714, of which Missouri contributed $129,779. For 28 weeks the total is $13,149,952.

MONTANA

Butte.—The U. S. Bureau of Mines rescue-car finished a week of training miners and works employees on July 13. Over 100 men attended the first-aid classes.

Anaconda is sinking the shaft in its Original mine 500 ft. from the 3400-ft. level. This will be the deepest in the district.

The Butte & Superior company and employees subscribed $180,000 to the third Liberty Loan. Employees in the Service now number 169.

On July 30 Butte Copper & Zinc pays an initial dividend of 50c. per share, equal to $205,850. The Emma mine, worked on a 50-50 basis with the Anaconda company, produces 250 tons of 'pink' manganese daily, also 150 tons of zinc ore.

NEVADA

Ely.—Nevada Consolidated has advanced wages 50c. per day, effective July 1.

Goodsprings.—On the 700-ft. level of the Yellow Pine mine an immense orebody has been exposed. An electric-air drill is doing good work at 900 ft. depth.

Tonopah.—Ore production of the district last week was 10,237 tons valued at $174,029. June outputs were:

Mine	Tons	Silver, oz.	Gold, oz.	Profit
Belmont	8,985	110,439	1,120	$61,032
Extension	10,533	129,774	1,210	67,307
Jim Butler	2,210	.....	....	29,829
Tonopah Mining	13,950	103,926	1,028	34,460
West End	....	105,353		....

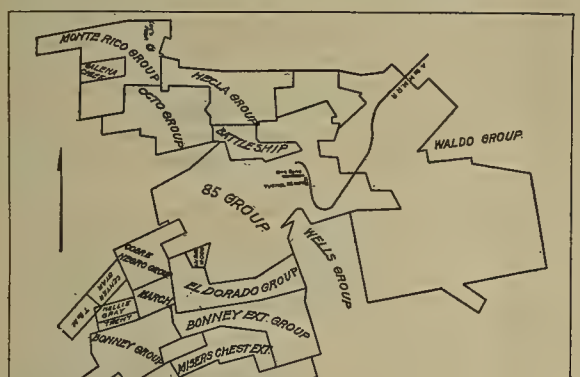
The Extension profit is $27,580 more than in May. This is due to the Murray and Merger veins at a depth of 1680 feet.

The Nevada-California Power Co. has completed a transmission-line to the Divide district. Interesting development continues at all of the new mines there.

NEW MEXICO

Hurley.—The old Lone Mountain district, 1¼ miles west of here, deserted for 25 years, is again receiving attention.

Lordsburg.—The 400-ton mill of the Eighty-Five Mining Co., employing gravity and flotation methods of concentration, has recovered 90% in its first month's run.



PROPERTY MAP OF LORDSBURG DISTRICT, NEW MEXICO

The Bonney mine is shipping ore regularly to Douglas, Arizona. This averages 4 to 9% copper, $6 gold, and $3 silver per ton. The 500-ft. level is opening well.

The Atwood, adjoining the '85,' is being re-opened by H. V. Snell and others of Globe. The 300-ft. shaft is to be sunk to 1000 ft. W. H. Tangye is in charge.

The Hecla company is preparing to start work on its claims three miles south of Lordsburg. R. E. Van Druff of San Diego, California, is president.

The old Last Chance mine, eight miles south, has been acquired by Pittsburgh people. B. Prescott of the Bonney and '85' companies will supervise the work.

Some high-grade gold-silver-lead ore is to be shipped from the Caesar Brock mine, 20 miles north of here.

Motor-trucks are to carry fluorspar from the mines at Redrock to rail at Lordsburg. It is intended to ship 65 tons daily.

Development at the Last Chance mine here is reported to be encouraging.

Magdalena.—The Buckeye Copper Co., sinking a shaft 10 miles east of this place, has opened rich sulphide ore at a depth of 150 feet.

Pinos Altos.—The Calumet-New Mexico Mining Co. is erecting a 100-ton mill here to concentrate zinc-lead-silver-gold-copper ores. The Langston mine was recently acquired containing 18,000 tons of ore.

Santa Fe.—According to the State Tax Commission, mines in 10 counties last year produced ores and coal worth $1,050,224, but the cost was $1,348,162, making a loss of $297,938. The returns show the following:

County	Value of ore	Loss	Profit
Colfax (ore)	$7,970,009	.....	$2,562,667
Dona Ana (ore)	897	$2,903	.....
Grant (ore)	25,877,370	.....	13,860,164
Grant (ore)	285,628	47,189	.....
Luna (ore)	17,770	.....	2,534
Lincoln (ore)	18,834	4,614	.....
McKinley (coal)	601,566	206,035	.....
McKinley (coal)	899,573	.....	138,095
Otero (ore)	119,783	.....	15,995
Otero (ore)	47,171	7,976	.....
Rio Arriba (ore)	8,677	.....	2,457
Socorro (ore)	2,211,107	597,396	.....
Taos (ore)	2,243	43	.....
Torrance (ore)	8,484	.....	3,443
Torrance (ore)	7,621	905	.....

OKLAHOMA

Picher.—Production of the districts last week was 5321 tons of blende and 654 tons of lead, valued at $374,365.

At the White mine, three ball-mills have been put in, one to take the overflow from the two rougher-jigs, one to take the tailing from the sand-jigs, and one to take the middling from the first tables. After being ground the pulp is once more sent over the tables. The manager, W. J. Borries, states that before the mills were used, tailing assayed 2½% blende, since reduced to 1½%. This mill also has a flotation plant at work.

UTAH

American Fork.—The new mill at the Bellerophan mine is at work. Ore-reserves are estimated at 10,000 tons, assaying $25 per ton.

Gold Hill.—The Western Utah Copper Co. is to build a 100-ton concentrating plant for its 2% ore.

Oakley.—Twenty miles from this place in Summit county, and two miles from the Idaho and Nevada borders, the Bipont Silver Mining Co. has taken a $250,000 bond and lease on 56 claims. It is said that over 100,000 tons of rich silver-lead ore is available. The company's capital is $100,000. J. B. Randall of Oakley is secretary. A mill is to be built to concentrate 15-oz. silver and 12% lead ore.

Park City.—To connect the Judge tunnel with the Daly West shaft over 500 ft. has been driven. The daily progress is 13 ft. The Daly West mill is to treat old tailing.

The Naildriver mine is said to be opening encouragingly.

Salt Lake City.—More than 1000 employees of the Magna and Arthur plants of the Utah Copper Co. on July 17 discussed the wage question, and to take action regarding the increase of $1 per day, which they now ask of the company, and of which 50c. has been granted. A request is to be presented to R. C. Gemmell, general manager for the company, advising him that the men still asked an increase of $1 per day, with time and a half for Sundays and holidays. The alternative is that the matter be taken up with the War Labor Board at Washington and the State Industrial Commission.

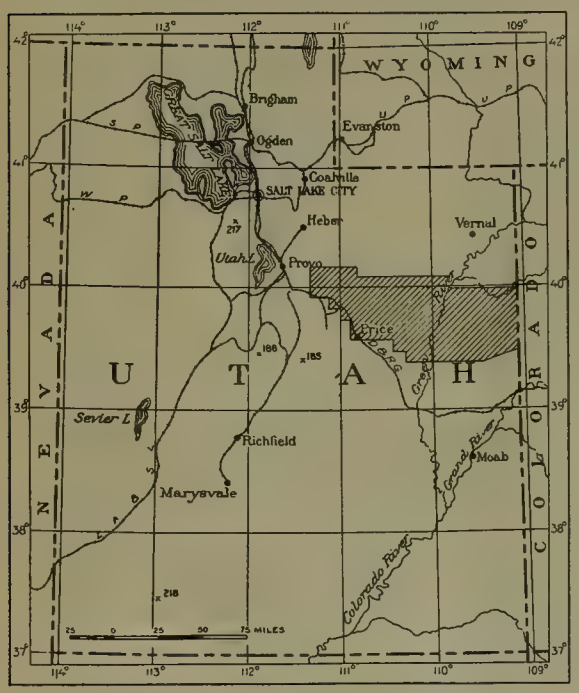
Tintic.—Dragon Consolidated paid 1c. per share, equal to $18,750, on July 25. This makes $56,750 for 1918, and $131,250 to date.

Iron Blossom also paid 2½c., equal to $25,000, on July 25. This makes $3,150,000 to date.

The Chief Consolidated has declared a dividend of 12½c. per share, payable on August 3. This amounts to $110,530, making $287,370 for 1918, and $1,124,341 to date.

The railway that was to be built into the West Tintic district has been delayed indefinitely due to present conditions. This will handicap development and production from a number of mines.

Two U. S. Geological Survey Bulletins—No. 690-C and



PART OF UTAH, SHOWING THE UINTA REGION

691-B—dealing with the Uinta region, have just been published. The first described a geologic reconnaissance of the Uinta mountains, with special reference to phosphate; this is by A. R. Schultz. The area lies in northern Utah along the Uinta mountains. The north side of the field can be reached by wagon from Rock Springs, Green River, or Evanston in Wyoming, on the Union Pacific, a distance of 40 to 80 miles. From the west end of the range the route is by way of Provo on the D. & R. G. Another route starts from Park City. There are two routes from the south: (1) by stage from Price or Vernal to Myton, then by private conveyance 65 miles farther; and (2) from Colton on the D. & R. G. by stage to Duschene, then 40 miles by private outfit. The area is sparsely inhabited. The phosphate rock, the more massive of which is found as float, resembles a dark coarse granular limestone, which might be mistaken for a dark fine-grained basalt or very fine sandy conglomerate. There were 37 samples taken during the examination, varying from 9.09 to 67.47% tri-calcium phosphate. There is a large quantity of rock available. Lack of transportation facilities is the chief obstacle to development of this necessary fertilizer, but construction of the Moffat line from Craig, Colorado, to Salt Lake City will bring it within a few miles of rail.

The second publication by D. E. Winchester discusses oil-shale of the Uinta basin of north-eastern Utah. The evidence to hand indicates that shale may be present beneath a great part of the basin, and the Utah portion is estimated to contain 42,800,000,000 bbl. of crude shale-oil and 500,000,000 tons of ammonium sulphate as a by-product. Railroads and wagon-roads are scarce.

CANADA

British Columbia

Princeton.—The Canada Copper Corporation, operating the Copper Mountain mine near here, also the Mother Lode near Greenwood, and a smelter at Greenwood, reports as follows for 1917:

Net earnings from the Mother Lode and Lone Star mines were $152,690. Due to fuel shortage the smelter worked more or less spasmodically, and reduced 30% less ore than in 1916. The Mother Lode continues to yield 600 tons daily, and can do this for a considerable time. In 1917 the 181,189 tons averaged 0.917% copper, 0.17 oz. sliver, and 0.038 oz. gold per ton. The Lone Star yielded 4780 tons, assaying 1.94%, 0.14 oz., and 0.026 oz., respectively. Its future is not bright. The smelter yielded 4,247,316 lb. copper, 46,356 oz. silver, and 9592 oz. gold.

At Copper Mountain, development and diamond-drilling continued to prove previous estimates, according to the consulting engineer, Allen H. Rogers. Reserves are 10,000,000 tons assured and 2,000,000 tons probable, averaging 1.74% copper and 20c. per ton in precious metals. The main haulage-level, to connect with the upper workings, was started on October 10, 1917, and finished on March 12, 1918. It is 2903 ft. long, 10 by 11 ft. in finished section. Other preparatory work is under way, all of which will be ready before the new mill, some time late in 1919. In a 50-ton mill 3000 tons was treated and a flow-sheet prepared for the large plant. Lawrence Addicks advised on concentrate treatment, which will include nodulizing and reduction in blast-furnaces. The mill is to be 9 miles from the mine and 4 from Princeton. The Kettle Valley Railway Co. is building a 13-mile line, and the Okanogan Power Co. a 100-mile transmission-line. There was spent at Copper Mountain in 1917 the sum of $622,720. Oscar Lachmund is general manager, and F. S. Norcross Jr., superintendent of mines.

Grand Forks.—Granby Consolidated has advanced wages to all employees at its smelter 25c. per day, from July 1. The men now receive $1.25 above normal wages, which are based on copper at 16c. Although the metal has been 23½c. for the past year the company has paid its men on a basis of 24c. copper.

Slocan.—Gneissic-galena ore from this district was examined by W. L. Uglow and discussed in 'Economic Geology' of a recent issue. Orebodies are fissure veins and replacements in schists, quartzites, and finely-crystalline limestones (Slocan series), and in the Nelson grano-diorite, and are usually within 3 or 4 miles of the contact. Most important deposits are fissures cutting the Slocan slates. In these veins the gneissic, or banded, galena ore is found. It is the characteristic lead ore of the district, although all of it is not of banded texture. In the Standard mine near Silverton, galena is especially abundant in this form. Ore-

zone in this property nas been developed by over 16,000 ft. of drifts through a vertical depth of over 1200 ft. Walls of lode are usually smooth and slickensided, evidence of considerable differential movement. Ore minerals occur in lenticular masses varying in extent, as much as 25 ft. thick. Between lenses is argillaceous material, containing stringers and irregular bunches of ore and gangue. Characteristics of the lodes suggest that the fracture-zones in which they occur have been subjected to considerable shearing, and that the individual lenses or sulphide masses were originally part of a more or less continuous vein that paralleled the direction of the fracture-zone. Some gneissic-galena ore has been found in the Interstate-Callahan and Minnie Moore mines, Idaho.

Trail.—The Consolidated M. & S. Co.'s smelter received almost similar quantities of ore during the first half of 1918 and 1917, as under:

Month	Tons, 1917	Tons, 1918
January	36,570	27,404
February	40,967	33,989
March	42,949	41,725
April	25,909	37,029
May	15,969	21,162
June	15,969	21,162
Total	172,493	179,274

Trail.—The Consolidated M. & S. Co. is to give its employees 15c. per day extra in May, and 25c. from June to November 1.

Victoria.—The annual report of the Minister of Mines of British Columbia for 1917 has been issued. It is the first to contain reports from the District Mining Engineers who were stationed in different parts of the Province during the past year. Figures of production prove that the preliminary estimate published months ago were very close, the estimated production being $37,182,500, against a definitely established total of $37,010,392.

Ymir.—The Hobson Silver-Lead company, operating the Yankee Girl mine, is considering the erection of a concentrating plant. Present daily shipments of silver-gold ore are 50 tons. W. T. McDowell is manager.

Ontario

Cobalt.—The Buffalo Mines report for the year ended April 30, 1918, shows that the revenue was $831,286, of which $264,282 was profit. Current assets total $677,175, and liabilities $32,061. The report of the superintendent, T. R. Jones, shows that there is 13,989 tons of 17-oz. ore broken in the mine, also 3000 tons of material in old stopes. There is no developed ore, although pillars will yield some. On dumps is 6000 tons of 11-oz. ore, also 100,000 tons of 6-oz. tailing. The mill treated 28,481 tons of ore and 88,534 tons of tailing, yielding 729,298 oz. of silver. The refining plant for treating flotation concentrate was abandoned, and arrangements made with smelters to handle this product.

Porcupine.—The Porcupine-Crown company is opening one of the best ore-shoots in its mine at a depth of 1110 feet.

The United States Patent Office at Washington desires us to call attention to the need for technically-trained persons for the examining corps of the Patent Office. Men are desired who have a scientific education, particularly in higher mathematics, chemistry, physics, and French or German, and who are not subject to the draft for military service. Engineering or teaching experience in addition to the above is valued. The entrance salary is $1500. Examinations for the position of assistant examiner are held frequently by the Civil Service Commission at many points in the United States. One is announced for August 21 and 22. Details may be had upon application to the Commission at Washington or to the Patent Office.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

H. C. Hoover is in London.

Waldemar Lindgren is at Bingham, Utah.

C. W. Walters has enlisted in the U. S. Navy.

Arthur W. Stevens has returned from Nicaragua.

Gelasio Caetani is now a Captain in the Italian army.

G. F. Sever, of Washington, D. C., is at the Stewart hotel.

Forrest Marshall is at the St. Francis hotel from Victoria, B. C.

James F. Kemp has gone from Tulsa, Oklahoma, to New York.

J. M. Boutwell passed through San Francisco on his way to Arizona.

F. A. Beauchamp has gone to the Ohio Copper company's mill at Lark, Utah.

L. D. Ricketts was in San Francisco on July 20. He is now at Warren, Arizona.

Herbert G. Thomson, of Rochester, Nevada, is taking a short holiday in San Francisco.

Leslie Brown, of the Consolidated Gold Fields staff, is now a Lieutenant-Colonel, with the D. S. O. He has returned to London from East Africa.

A. Winter Evans, general manager of the Consolidated Goldfields mines at Reefton, New Zealand, and known in the United States, was killed in France recently.

Alfred D. Flinn, secretary to the United Engineering Society, addressed the engineers of San Francisco on July 23 on the subject of 'The Engineering Council.'

O. R. Whitaker of Denver, Colorado, has been retained by the Canadian government to assist in investigating smelting charges in British Columbia, particularly at Trail.

G. H. Parsons, chief chemist for the Ray Consolidated Copper Co. at Hayden, Arizona, has resigned and enlisted in the Gas Defense Service at Astoria, Long Island, New York.

G. F. Coleman, superintendent of the Noble Electric Steel Co.'s smelter at Heroult, has resigned to accept the position of manager of ferro-alloys for the United States Steel Corporation.

H. R. Edmands, who has been active in improving the precipitation of gold from cyanide solutions by charcoal in Western Australia, has gone to the Globe & Phoenix mine, in Rhodesia.

D. H. Angus has resigned as general manager for the Tough-Oakes Gold Mines Ltd. of Kirkland Lake, Ontario. He will retain the management for the Right of Way Mines Ltd. at Cobalt.

Oliver W. Krull, formerly of the metallurgical staff of the Chino Copper Co., later associated with the mining department of the Compañia Minera de Peñoles at Ojuela, Durango, Mexico, is now superintendent of the same company's lead smelter and white arsenic plant at Mapimi, Durango.

W. L. Cole, general manager of the Mountain Copper Co.'s interests in Shasta county, has resigned, having been with the company since it commenced operations at Keswick and Iron Mountain, 23 years ago. **Morton J. Murphy**, assistant general manager, will succeed Mr. Cole. **E. L. Stenger** will succeed Mr. Murphy.

The Australasian Institute of Mining Engineers has 582 members, of whom 119 are in the Service.

THE METAL MARKET

METAL PRICES

San Francisco, July 23

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound.	15
Copper, electrolytic, cents per pound, in carload lots.	26.00
Copper, electrolytic, cents per pound, in small quantities.	27.30
Lead, pig, cents per pound.	8.30— 9.30
Platinum, Government price, per ounce.	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound.	11
Zinc-dust, cents per pound.	17½

ORE PRICES

July 23

Antimony, 45% metal, f.o.b. California, per unit.	$1.10
Chrome, 38 to 48%, California, per unit.	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco (Woods, Huddart & Gunn), per ton.	$22—$30
Magnesite, crude, California, per ton (nominal price).	$7.00—$8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29).	$0.86—$1.30
Manganese, domestic, 35 to 54%, f.o.b. east of South Chicago, per unit (Government price, effective May 29).	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2.	$1.25
Pyrite, per unit of sulphur, cents.	28
Tungsten, 60% WO_3, California, per unit.	$20—$24

EASTERN METAL MARKET

(By wire from New York)

July 23.—Copper is unchanged. Lead is quiet, though strong. Spelter is dull and easier.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange.

1918	New York, cents	London, pence	Average week ending	New York, cents	London, pence
July 17	99.62	48.81	June 11	99.50	
" 18	99.62	48.81	" 18	99.50	
" 19	99.62	48.81	" 25	99.50	
" 20	99.62	48.81	July 2	99.50	
" 21 Sunday			" 9	99.62	
" 22	99.62	48.81	" 16	99.62	
" 23	99.62	48.81	" 23	99.62	

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	....
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	....
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	....
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

A Chinese customs publication gives the following figures on imports and exports of treasure during the last calendar year, in Haikwan taels ($1.08 U. S. average during 1917):

Gold

	Bars, dust, etc.	Coin	Total
Imports	711,036	13,160,742	13,871,778
Exports	4,700,424	324,151	5,024,575

Silver

	Bars and sycee	Coin	Total
Imports	16,197,966	11,309,326	27,507,292
Exports	33,080,586	15,409,804	48,490,390

These figures show a net import of gold amounting to 8,847,203 Haikwan taels, and a net export of silver amounting to 20,983,098. These respective totals, calculated at the average value of the tael given above, are equal to about £1,909,000 ($9,130,000) and £4,530,000 ($21,700,000). Although other factors enter into the composition of the large exports of silver, the contrast between the movements of the two metals certainly indicates that the Chinese consider gold cheap and silver dear, at the prices current during the period, according to Samuel Montagu & Co. of London.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.30c., respectively, until August 15. Quotations in cents per pound are as under:

Date		Average week ending	
July 17	26.00	June 11	23.50
" 18	26.00	" 18	23.50
" 19	26.00	" 25	23.50
" 20	26.00	July 2	23.50
" 21 Sunday		" 9	26.00
" 22	26.00	" 16	26.00
" 23	26.00	" 23	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	....
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	....
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
July 17	8.05	June 11	7.31
" 18	8.05	" 18	7.81
" 19	8.05	" 25	7.82
" 20	8.05	July 2	7.90
" 21 Sunday		" 9	7.99
" 22	8.05	" 16	8.05
" 23	8.05	" 23	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	....
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	....
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
July 17	8.75	June 11	7.56
" 18	8.75	" 18	7.70
" 19	8.75	" 25	8.18
" 20	8.62	July 2	8.78
" 21 Sunday		" 9	8.85
" 22	8.62	" 16	8.78
" 23	8.62	" 23	8.68

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	....
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	....
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds:

Date			
June 25	110.00	July 9	120.00
July 2	120.00	" 16	120.00
		" 23	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	....
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	....
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	....
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	....
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ORES (New York)

Antimony: Quotations are nominal at $1.10 to $1.25 per unit.

Ferro-manganese: The blast-furnace report of 'The Iron Age' for June, revised, shows the June output of domestic ferro-manganese, including electrolytic, to have been 29,568 long tons, and spiegeleisen 16,398 tons.

Molybdenum: The market is quiet at $1.25 per pound of MoS_2, and a small business is reported. There has been inquiry from foreign buyers.

Tungsten: The market has been active with considerable high-grade ore sold. Scheelite has sold as high as $24.50 per unit. Low-grade ore brought $18 to $22. Demand for nearby pure ores is strong. Ferro-tungsten is unchanged at $2.40 per pound of contained tungsten.

The alien property custodian, A. Mitchell Palmer, announced on July 22 that he had taken over the business of L. Vogelstein & Co. and Beer, Sondheimer & Co., metal merchants of New York City.

Eastern Metal Market

New York, July 17.

There is a scarcity in most of the metals, and all prices are strong. Demand in several is urgent.

Copper is quiet at the new Government maximum price.

Tin is extremely dull, but quotations tend upward.

Lead is firmly held at levels agreed upon by leading producers, but is scarce.

Zinc is not active, but quotations, while a little lower, are regarded as firm.

Antimony is quiet and unchanged.

The meeting in New York between the steel producers' committee and the Director of Steel Supply on Monday resulted in no agreement as to steel rail and other prices under discussion and referred to last week. While only 100,000 tons of rails are needed for 1918 the Railroad Administration wants the price fixed principally because of the large purchases to be made for 1919. The stand taken for a $42 price for bessemer rails is in the face of an average cost of $50 or more and the contention of one producer that he should have $60 for bessemer and $65 per ton for open-hearth rails. It now looks as though essential war-needs will absorb practically all of the open-hearth steel output of the country for this year, and that whatever is permitted for general purposes must be filled wholly with bessemer steel. Plate mills are producing at a yearly rate of 6,000,000 tons, while new capacity may bring the rate up to 7,000,000 tons by January. Tin-plate production continues at a record rate.

COPPER

The question of adjustments of various kinds, growing out of the sudden change in the price of copper on July 2, is the uppermost topic in copper circles. Consumers who have manufacturers' material to furnish on contract, and who based their contracts on the old 23.50c. price, find themselves in a serious position. There have been meetings of certain large brass and wire makers to discuss this phase of the problem and to find some way to present their side to the Government. As to contracts entered into between May 31 and July 2 at 23.50c., it is probable that producers will fill these at the old price where deliveries have not been made. Government and Allies' supplies seem to be a different matter. It is stated that there was no general agreement with them and that some orders were taken and some were not. Attention is directed to another difficulty in the case of manufacturers who enter into contracts on the basis of 23.50c. and did not cover their needs for copper. Encouraging reports of raw copper in June are coming in. In general the market is very quiet and not much is being contracted for at the new price of 26c. per lb. The fixed maximum for jobbing lots of 5 tons or less is 27.30c. per lb. The question of the price to obtain after August 15 is to be taken up at Washington on August 7. Talk continues to be heard of a 27c. price after August 15. It is asserted confidently in some quarters that a 30c. price will be in effect before or by the end of the year.

TIN

The market continues devoid of transactions and is extremely dull. The only business reported is occasional sales of small lots of Banca or Chinese tin in transit. The supplies of British tin are dwindling, and prices in London are advancing. The license situation over there is tightening, and no Straits or Lamb and Flag tin is being offered. Two licenses are now necessary to do business there, one to ship the tin and one to sell, the latter license being necessary first. The granting of either at present seems difficult or impossible to get, according to present advices on this side. Buyeres here are not pressing their needs, for they know it to be of little avail. They merely wait for such offerings as present themselves. The quotation for spot-tin is a little higher at 94c., New York, but is entirely nominal. It is at least interesting to record the strange fact that, whereas before the 25% increase in freights was allowed, the rate from Pacific ports to Eastern points on tin was 56.2c. per 100 lb., now it is $1.25 per 100 lb., or an increase of over 100%. The question of duty has again come to the front. There is talk in Washington of the placing of an ad valorem duty of 10 to 20% on all imports now free. This would include tin, but the buyer or consumer would have to pay it. Arrivals continue fairly good. Those at Atlantic ports thus far in July have been 625 tons, with those at Pacific ports 1925 tons. Again, there is not the usual estimated quantity afloat reported. As indicated above, London prices are higher. Yesterday spot Straits was quoted at £365 10s. per ton as against £340 a week ago.

LEAD

Conditions are essentially the same as for some little time past. Most producers are sold up for July, and most or all of August, and the metal is extremely scarce. The quotation is still held in bounds by agreement at 7.75c., St. Louis, or 8.05c. per lb., New York, and efforts to so maintain it are concerted and vigorous. The scarcity is due almost wholly to Government requirements. The demand in general is large and urgent. If producers had more to sell it would indeed be difficult to quote on any delivery, except New York or St. Louis, because of the freight-rate tangle. The increase in the rate to New York of over 75% has unsettled matters. It is believed that quotations to other points than New York will be on the St. Louis basis, plus the freight rate, whatever it is. A meeting in Washington lately to discuss the rate question is understood to have resulted in no clearing up of the situation. Japan is in the market again.

ZINC

The market is slightly easier but nominal at 8.50c., St. Louis, or 8.75c., New York, for early or third-quarter delivery. The premium for fourth-quarter has disappeared and no one is asking more than 8.50c., St. Louis, for that position. For early delivery as high as 8.60c., St. Louis, has been realized this week for small lots, while there are some willing to shade slightly 8.50c., St. Louis. Demand, however, is light and offerings are not large. Some producers are pretty well sold up, while other large ones are not eager to sell. There are some small ones who are anxious to do some business. The lag in the recent upward movement is regarded as welcome, and some regard the market as firm at present levels for some time. The situation in general is more satisfactory and healthy than in some time, and a fair profit is regarded as possible now for most producers at present price levels. Grade A zinc has a maximum Government price of 12c. per pound, but it has been sold under this.

Sheet zinc is fixed at 15c., with plate zinc at 14c. per pound.

ALUMINUM

Government prices continue to rule for scrap and No. 1 virgin metal, 98 to 99% pure, at 33c. per pound in lots of 50 tons and over, 33.10c. in lots of 15 to 50 tons, and 33.20c. in 1 to 15-ton lots.

INFORMATION FURNISHED BY MANUFACTURERS

THE TANKS

By Col. E. D. Swinton

*Ever since the appearance of the magazine rifle the advantage that would be conferred on the attack by employing a moving armored shield, fort, or cupola, has been so obvious that a vague consciousness of it has probably at some time or other formed the subject of the day-dreams even of those not directly concerned with war, but happening to possess some knowledge of military history and mechanics and to be blessed with imagination. Since the introduction of the machine-gun, and the more recent appearance of the armored motor-car of the ordinary wheeled type, the idea of constructing some such engine has occurred to the minds of many more, especially to engineers.†

But, as the Bible has it, "Better is the sight of the eyes than the wandering of the desire," or, in other words, it is one thing to dream and another to convert a dream into actuality. It would, no doubt, be of interest to make some reference to the personal element and the share of responsibility attributable to individuals for the realization of what has long been a subject of aspiration. This, however, is neither the time nor the place to do it. The subject has already been rendered controversial by the contradictory statements and the various claims for the credit of the invention that have appeared in the press. The truth is that several people have been concerned to a greater or lesser degree at different stages, though the merit of inventing some of the crucial mechanical details can be ascribed definitely to individuals. Nevertheless, one assertion has been publicly made by a writer of eminence and weight, which must be refuted. H. G. Wells, who prophesied to the world the arrival of such a monster as the tank so long as 13 years before it appeared, and who, in his 'War and the Future,' published in 1917, gives an excellent description of the existing machine, and a most illuminating imaginative forecast of its future evolution, both implies and states specifically that the tanks have not come from military sources, but have been thrust upon the soldiers from without. This is a sweeping indictment, reiterated complacently and with apparent satisfaction, but incorrect and presumably based on ignorance of the facts. It is true that certain people who are not soldiers have played a large and valuable part in creating the tank. It is also true that others who are soldiers have not done so, but the first to appreciate the necessity for it, to urge its provision, and to insist on the feasibility of its construction, were, in fact, soldiers. This point is emphasized, not because it is either remarkable or praiseworthy on the part of any men that they should be the first to realize the need for an obvious development connected with their own profession, but in justice to those who can neither make speeches nor write to the press to defend themselves against mis-statements, even when publicly made. Moreover, those soldiers who gave the impulse for this innovation did so without knowledge of Mr. Wells' brilliant forecast.

The first definite proposal for a fighting machine on the lines of the existing tank was due to the appearance of the Hornsby-Ackroyd caterpillar tractor, which was tested for military traction purposes in England in 1906-1908. It was made by a military officer, and was carried to the stage of preparing sketch drawings, when the project died for want of support. Like Mr. Wells, he was ahead of his time. Independently, without knowledge on their part of the previous abortive effort, a similar idea took shape in the minds of other soldiers at the very beginning of the War; and it will specially interest the American reader to learn that it was on this occasion inspired by an invention from the country in which new ideas are supposed always to be welcome. In July 1914 it became known that there was in existence an automobile for agricultural purposes, propelled on the caterpillar principle, which possessed unusual powers of crossing rough ground and of traversing obstacles. This was the Holt tractor, made in Peoria, Illinois. The accounts of the performances of this machine, constructed for haulage and not specially for climbing, suggested that one similarly designed especially to travel across country would, except in speed, have all the value of the existing armored motor-cars without their limitations. The immediate incentive to action on the part of those responsible for the tank, therefore, was the fact that the construction of such a machine at last seemed to be practical. Even its most ardent backers, however, did not then fully realize how great the need for it was. The War had not lasted long, however, before this was made clear.

With their proverbial thoroughness, the Germans had not only studied the Russo-Japanese war, but had turned their studies to good account. One of the outstanding lessons of that struggle was the great value of machine-guns on the defensive, especially exemplified in the battle of San-de-Pu and at Port Arthur, and, in preparation for the conflict that they had good reason to know was coming, the Germans had, either in accordance with the deductions made, or as a result of their own experiments, secretly provided themselves with thousands of these weapons, and trained a large body of picked troops to man them. It is stated that the total number in their possession in August 1914 amounted to upward of 50,000. The worth of these guns was soon proved, firstly, in the attack and then in the defensive, both in delaying rear-guard actions conducted by detachments, and in protracted resistance carried out by large forces. Every offensive undertaken by the Allies on the Aisne, and afterward, bore witness, in the toll of balked assaults and infantry losses, to the stopping power of these weapons, and justified the astuteness of the enemy general staff. Each attack also showed their comparative invulnerability, even in hastily-constructed defences, to the artillery which was available against them. Indeed, it may be said that the murderous power of the machine-gun, when used lavishly

*Abstract: Booklet published by George H. Doran Company, New York.

†M. Albert Robida, both in his writings and pictures in 'La Caricature,' predicted the use of tanks in 1883; see 'Strand Magazine,' June 1917.

and with skill—and the Germans are artists in handling it—came as a revelation to their enemies.

As time went on, with the operations assuming the character of siege warfare, the Germans had time to erect miles of barbed wire and other obstacles, and the effectiveness of their machine-guns was greatly increased. In proportion, also, as the defences, including the dug-outs and shelters for these guns, were elaborated, did the immunity of the

COLONEL SWINTON AT STOCKTON

latter from artillery fire keep pace with the gradually increasing weight and number of the Allied guns. This progressive improvement of the defences continued until the machine-guns were ensconced in caverns and galleries 30 ft. below ground-level during bombardment, and brought up only at the last moment for a point-blank battue of the attacking infantry. But long before the latter stage was reached it had been brought home to the protagonists of the tank that they were right. It became increasingly obvious that to launch assaults against the defence as organized by the Enemy, unless the positions were first blown to dust, was merely to throw the infantry into a maze of barbed wire in which they would be caught helpless as flies on 'tanglefoot' and mown down by rifle or machine-gun fire at short range poured in from different directions; or, if they were successful in getting over the wire into a trench, to subject them to enfilade fire from the same weapons placed for that object. It was established that, at all events until the British artillery increased in strength to a degree that would enable it effectively to cut the entanglements on the front of assault and blast the defences into shapeless mounds, it was essential to employ some moving bullet-proof device, which could not only climb forward and forge its way through uncut wire, but could knock out machine-guns in a straight fight. The offensive side of the projected machine then assumed greater importance; and it was realized that the tank should primarily be a machine-gun destroyer. If it be asked, therefore, what single factor was most instrumental in forcing the tank into being, it can be said that it was the logical exploitation by the Germans of the machine-gun, usually the Maxim, probably the most efficient weapon of wholesale destruction ever created.

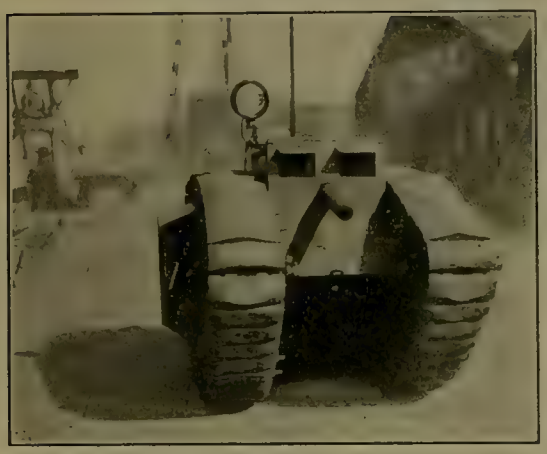
There is an English proverb that commends as a cure 'A hair of the dog that bit you.' It is an interesting fact, though hardly a coincidence, if national inventive characteristics be borne in mind, that one of the most deadly man-killing machines, which the world owes to the genius of one American, the late Sir Hiram Maxim, should have found its antidote in a device directly inspired by the invention of a compatriot, Benjamin Holt.

A word of general description and a few more upon the functions of the tanks. They are powerfully-engined armed automobiles, enclosed in a bullet-proof casing for the protection of their crews. Propelled on the caterpillar principle, they possess considerable powers of traveling over rough ground, both in crossing trenches, craters, and other cavities, and of climbing over raised obstacles, such as parapets. They can tear their way without difficulty through wire entanglements, can uproot fairly large trees, and can throw down the walls of ordinary dwelling-houses. Nevertheless, in spite of their elemental strength and apparent clumsiness, in the hands of skilled drivers they are as docile as trained elephants under their own mahouts.

They are divided into 'males' and 'females'. The male is par excellence the machine-gun hunter and destroyer. He carries light quick-firing guns capable of firing shell, and is intended to be to the machine-gun what the torpedo-boat destroyer was designed to be to the torpedo boat, or the ladybird is supposed to be to the aphis. The 'female', which, in accordance with the laws of Nature, is the man-killer, carries nothing but machine-guns for employment against the enemy personnel. Her special rôle is to keep down hostile rifle-fire, to beat back counter-attacks and rushes of infantry, and to act generally as a consort to her lord and master. Both, however, are heavy weights endowed with great brute force, and share, in common, the attribute of being able to roll out and flatten machine-guns and their emplacements. Both, therefore, act as protectors to infantry, in so far as they can destroy or 'blanket' the one thing which has proved its greatest bugbear in the attack. Moreover, every tank that goes forward, whether actually moving or disabled, assists the infantry near it in another way. It bulks above them and is the centre of

EMPLOYEES OF HOLT MANUFACTURING CO. LISTENING TO ADDRESS BY COLONEL SWINTON

attraction. It acts as a magnet for the bullets of the hostile machine-guns, and collects them to itself as Arnold von Winkelried is supposed, in 1386, to have drawn to his own body the spears of the Austrians at the battle of Sempach. Every bullet that clangs against its steel sides is one less aimed at the infantry. Each silvery star splashed on its hide is the signature of one that has not drilled its way



'FEMALE' TANK CARRYING MACHINE-GUN

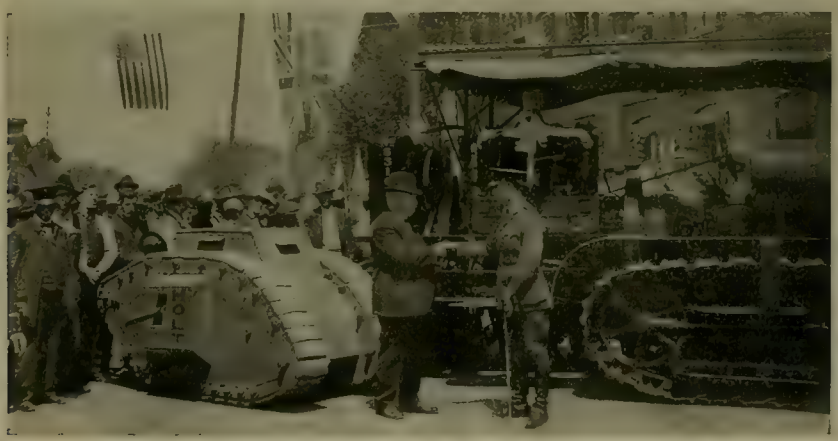
through the body of an infantry soldier. To be the nurse, protector, and backer of the attacking infantry, who, in the vernacular, 'always get it in the neck,' was the motive underlying the action of the new arm. As it was expressed in the exhortation given to the officers and men going forth to take their machines into battle for the first time, whatever mistakes might be made, whatever mischances might befall, if the tanks gave reason for their comrades on foot to thank God for their presence, they would have justified their existence.

It has been justified.

It is true that in any consideration of their employment too much importance must not be attached to some of the results of their first appearance, for certain influences then came into play which can never again have quite the same effect. Against the Germans they had all the advantages of being a surprise, and, by their strangeness, and the apparently irresistible nature of their advance, inspired terror. On our own infantry, on the other hand, their almost equally unexpected début, and their abnormality, had quite the contrary effect. It was a relaxation of tension, and a reaction which had its own particular value. The very grotesqueness of the machines, their ungainly indescribable method of progress, their coloring—surpassing in weirdness the sickliest fancies of the most rabid Cubist—were in reality great moral assets. They supplied the touch of comic relief, and excited the mirth of the British soldiers, always blessed with a keen sense of the ridiculous. They acted as an antidote to the effect of the Jack Johnsons, Weary Willies, Silent Susies, Whizz Bangs, Sausages, Rum Jars, Tear Shells, Gas Shells, and all the other frightfulness of the unspeakable Boche. They counteracted the weariness, the hunger and thirst, the dust, the mud, and all the squalor and filthy discomfort of war. As has been related in the accounts published at the time, it was a laughing cheering crowd of infantry that in many cases followed the tanks forward on September 15. On the other hand, the new engines underwent their baptism of fire, and there were failures due to this, which should not recur. Some of these results were produced by the factor of novelty, and are already discounted, but the solid material value of the tanks to the infantry remains.

Frederick Palmer, the American war correspondent with the British army, has estimated that in the latter stages of the battle of the Somme the intervention of the tanks, though many machines failed from mechanical and other defects, saved some 20,000 British lives, and subsequent estimates of the quality of the assistance rendered by them during May 1917 are similar. The most convincing proof of the difference made by their intervention is ocular, and is afforded by the 'pattern' of the field of battle over which a British attack has passed. Where tanks have accompanied the advance and have been able to eat up the enemy machine-guns left over by our bombardment, the bodies of our infantry strew No Man's Land irregularly, here and there. Where tanks have not been used, in some places the bodies can be seen to be lying in front of the enemy's machine-gun 'nests' and strong points, in swathes like cut corn; in a series of high-water marks showing where the successive waves of the assault have met and been petrified by the death-dealing spray of the German Maxims.

Not only have the tanks saved life by the moral effect of their approach and the number of machine-guns put out of action, but they have themselves taken an active part in killing; on some occasions, indeed, having played the leading rôle in what might be called a 'butcher's dream.' That



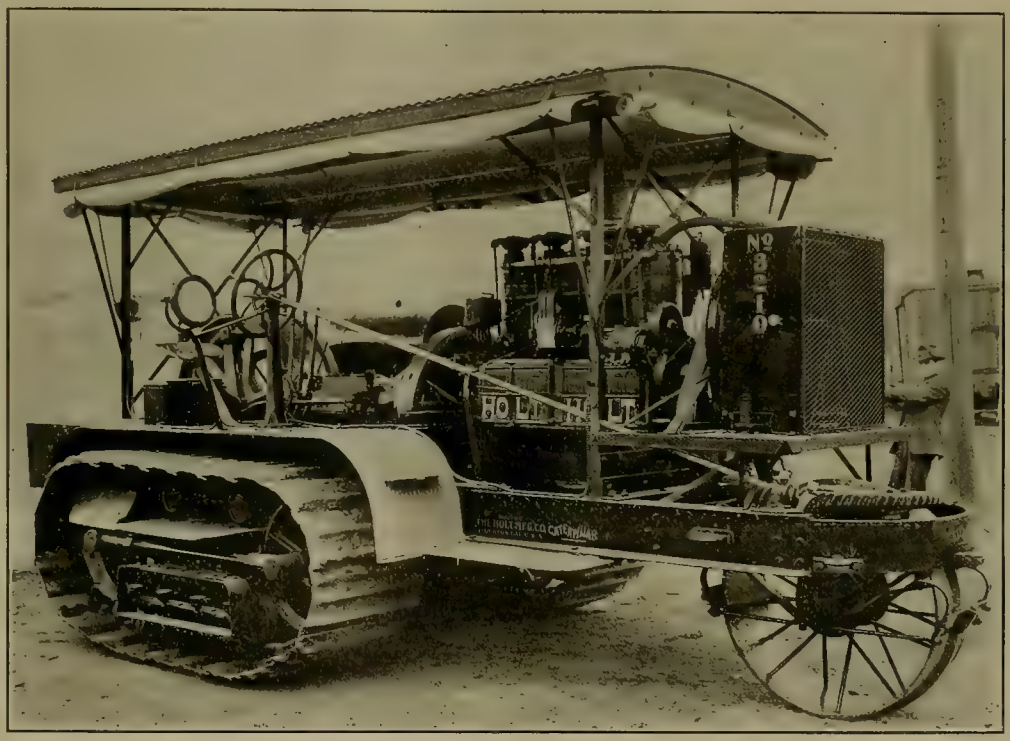
COLONEL E. D. SWINTON GREETING BENJAMIN HOLT AT STOCKTON, CALIFORNIA

the Germans appreciate the significance of the new development is clear from the instructions issued, and the elaborate protective measures taken. In spite of the ridicule usually poured on the new weapon by their newspapers articles do occasionally appear that sound another note. For instance, Lieutenant-General Baron von Ardenne stated in the 'Berliner Tageblatt' "These powerful armored cars, which were first used by the British, are undoubtedly the most wonderful weapons that modern tactics have revealed in warfare * * *"

This, the latest engine of war, has, of course, its limitations. For instance, tanks alone, in their present state of development, cannot push to a decision nor win a great action. That must still be done, as in the past, by the infantry, but Behemoth, clad in his bullet-proof skin, and

Colonel Swinton, now advanced to the rank of General, recently came to Stockton, California, to greet Benjamin Holt, and congratulate him upon the service that his labors in developing the Caterpillar tractor had rendered to the cause of the Allies. Addressing a mass meeting including the whole force of the **Holt Manufacturing Co.**, in that city, he said in part:

"I am indeed pleased to come here. Firstly, this is California and it is the first time I have visited it. Since I have been in this country I have heard the expression 'God's Country' pretty often. Sometimes I have spoken up and I have said, 'There is another 'God's Country' somewhere else,' but I haven't said very much. This is the third day I have been here and I think this must be God's special corner of the country. Of all places that I have wanted to visit,



A TYPE OF THE HOLT CATERPILLAR TRACTOR

urged onward by enormous horse-power, laughs at entaglements, and machine-guns are his 'meat.' His main object cannot be too often or too strongly emphasized; other ancillary duties need not be specified here. To the infantry soldier attempting to force his way by his own puny strength through mud or dust and groves of barbed wire, his body naked to every kind of missile, but more especially to the sleet of lead which whistles horizontally across No Man's Land, he is the mechanical big brother armed with the punch and the big stick. This little book may perhaps be read by some of the 'boys' from Massachusetts, Oregon, Texas, Pennsylvania, or other States of the Union, who, as members of the infantry of the United States Army, may find themselves in the not distant future scrambling across No Man's Land alongside their comrades of the Allied forces, who have already 'been over.' For them it may perhaps be permitted without presumption to add a word of counsel from one who, though not an infantry soldier, knows something about it. To the time-worn advice of: "Johnnie, get your gun," he would merely add: "And bring your tanks."

this is among the foremost because it is the original birthplace of the Holt tractor. The reason I take special interest in that is that I happen to be an engineer myself, and, as you know, had a good deal to do in the invention of a machine that has saved thousands of lives, a machine, don't forget it, that has taken thousands of lives, too, thank God! In July 1914 a friend of mine, a mining engineer, was looking for a cheap system of transportation. This was before the War. He usually tells me of his difficulties and gives me his ideas that might help me, and he wrote me and he said, 'I struck a Yankee machine in Antwerp that they call a Holt 'Caterpillar' tractor.' He said, 'This machine climbs like hell.' I had known of the soldiers wanting just such a machine ever since the time of Julius Caesar. I thought if this tractor climbs like hell, what was wanted was something that would climb to beat hell. Julius Caesar would like to have had it for his infantry.

"At the beginning of the War I had a peculiar position. I had a knowledge of the needs and incidentally I had the chance of seeing a lot of things, and I discovered a lot of things that had not been discovered before. The Germans

had secretly armed themselves with thousands of machine-guns. The machine-gun is the most perfect man-killing gun that has ever been made. The Germans manufactured it in England under a British royalty. For a time before the War broke out, they did not pay any royalties and did not submit any accounts. They knew the War was coming. They started the War with about 50,000 of these guns ready. Our men went out against these machine-guns and they were killed in thousands. The machine-guns were at them on every side. They are a fine machine and the enemy used them well and they mowed our men down by thousands and it appeared that the idea I had in July 1914, if employed, might produce a machine that would climb to beat hell, which was absolutely right. We must have something that would go across trenches and over barbed wire. To cut a long story short, there were men being killed by the thousands by these machine-guns. It was really a disease against humanity that was invented by the late Hiram Maxim, so you Americans have the credit of producing that disease, but you have the credit of producing the antidote, too. The antidote was the Holt 'Caterpillar' tractor produced by Benjamin Holt.

"Tractors have taken guns by the thousand. You men here who have toiled and sweated and have given your time and are working with your brains and your hands have given us splendid help, and the men 'Over There' appreciate your work and, men, don't you forget it! It is something to know when you are working away here and the work is tiresome and the day is hot, it is something to realize that the men on the other side do feel grateful toward the people who are making these things. And your machine is one of them that is doing work most worthy of gratitude.

"We started out to make that climbing machine, the tank, that machine to climb to beat hell, and it was the machine-gun destroyer, and it crossed every trench. They made these tanks, a large number of them, between August 1916 and March 1917 and we kept it a secret. It had been whispered around that they were reservoirs to take water to our troops in Egypt. Reservoirs was a good word, but it was a long word, and tank was a better word. This is camouflage. When we began to cut holes in the sides, the word went around that these machines were built as revolving snow plows for Russia. Upon every tank in the shops we had painted a sign, 'With Care to Petrograd.' It was a surprise to the Germans when they went out with their machine-guns to pour forth their ammunition and not see men falling down like cattle. You would be surprised too. The tanks were also used in large numbers at Cambrai last year. They have taken thousands of German prisoners, they cost us but a small amount of money, there were no horrors, and we lost practically no lives. I think this machine represents the beginning of a new development.

"Just one word more.

"I wish to give you a message from the other side, from my own people and from my own soldiers. I am not empowered to speak for the French, but, God bless them, they have put up a wonderful fight. And I am not empowered to bring you word from Italy, but I know they are all grateful to you. We are going to stick with it until hell freezes. I am going to take the message from you that you are standing back of the men and are going to keep them well equipped. You are in this war to win and it's a very big undertaking. I look upon Germany as a disease, and we have got to fight it and down it, and it has done me good in my tour through the States to think how everybody has responded from beginning to end."

HOLT CATERPILLAR TRACTOR DRAWING TRAIN OF TRUCKS IN THE DESERT

The Engineering Index Annual for 1917 lists and describes practically every article or engineering society report published in the United States or abroad during the year. The Index comprises about 250 publications representing 17 nations and colonies and six languages. About three-fourths of these journals are printed in English, the others being in French, Spanish, German, Italian, and Dutch. The Engineering Index makes readily available all the huge mass of material published by the engineering press of the world so that one can find without difficulty every article published. It can be obtained through the 'Mining and Scientific Press' for $3.

A. Niedermeyer, for many years connected with the Worthington Pump & Machinery Corporation, more recently as works manager of the Snow-Holly plant of that corporation, at Buffalo, New York, resigned on May 31 to devote his entire time to private enterprise.

The Dorr Company announces a change, effective August 1, in the address of its New York office to 101 Park avenue, where much needed additional space has been secured to care for the continued expansion of its business.

Edward J. Albert, for five years manager of the mining and power department of the Canadian Allis-Chalmers, Ltd., has become sales manager for the Thwing Instrument Co. at Philadelphia.

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Edited by T. A. RICKARD

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SAN FRANCISCO, AUGUST 3, 1918

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COURTENAY DE KALB, Associate Editor
M. W. von BERNEWITZ, Assistant Editor

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E. H. LESLIE, 600 Fisher Bdg., Chicago
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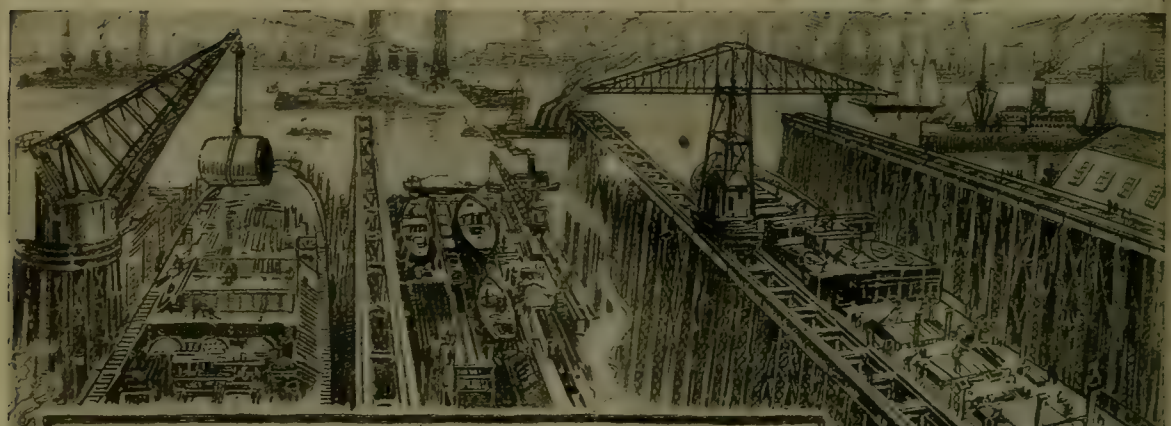

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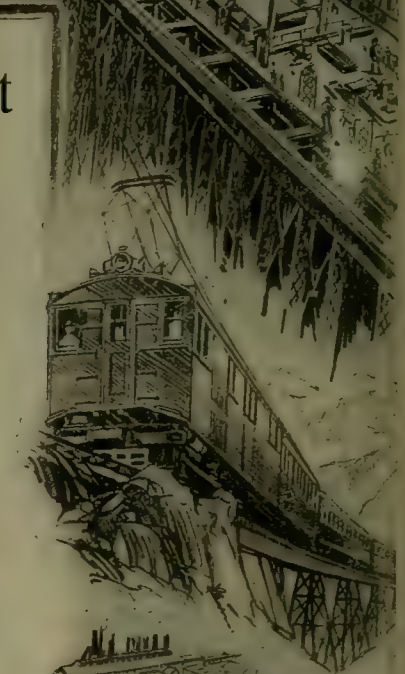

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GENERAL ELECTRIC COMPANY

EDITORIAL

EVERY intelligent democrat and patriotic citizen must have been glad to read the President's warning against mob violence, whether aimed against pro-Germans, I. W. Ws., or negro criminals. All lynchings and other acts of violence are "a blow at the heart of order, law, and humane justice."

THE Railroad Administration has authorized the sale, after August 1, of mileage scrip, good on all the roads in the country under control of the Government, at the basic rate of three cents per mile. The coupons will be accepted for transportation, sleeping-berths, and dining-car charges, but the war-tax must be paid to conductors on the presentation of the mileage-book.

IN consequence of prohibiting the importation of graphite a sufficient supply for domestic needs has been developed in this country. The War Trade Board accordingly has extended the restriction to graphite crucibles, effective from July 15, this order applying to all outstanding licenses for the introduction of these wares. The restriction on graphite, originally limited to July 1, has been extended to the end of the year.

WHY baseball-players should be held in such tender regard at this time we fail to understand. The spectacle of the Secretary of War holding a conference with base-ball 'magnates' over the question of drafting professional athletes engaged in the most commercial of all sports is ludicrous. No sport is more prostituted to money, even the teams being 'owned' by sundry rich men and exploited for profit. Moreover, base-ball is essentially a spectacular game, involving the time of people that do not take outdoor exercise themselves but pay to watch others. Why should a husky base-ball player be excused from military service when others far more useful are drafted?

APPARENTLY the Senate of the United States has time for amusement, if one is to judge from the length of the speech delivered by Senator Sherman when attacking Mr. George Creel. The speech is an amazing example of vituperation, and it would be funny if we were not in the midst of a great war. Sample copies of Mr. Creel's 'Official Bulletin' have reached us; it appears to be a waste of good paper; indeed, several branches of the Government set a bad example in their squandering of paper and postal facilities, although this has not hindered the War Industries Board from scolding sundry periodicals for doing the same thing. Why does it not make an effort to stop the wastage involved in the Sunday supplements of the yellow press, which, as Senator Sherman says, "in peace is a pestilence, in war a skulking menace."

PERU is making known her resources in an intelligent manner through the medium of bulletins conveying technical information in popular form. This is done through the Cuerpo de Ingenieros de Minas, ostensibly and in reality a society of technical men, but under the supervision of the Ministry of Fomento, or industrial administration. This method of linking the men of professional training directly with the Government is not peculiar to Peru. We mention the practice in that country merely because we chance to have before us the latest publication of the 'Corps of Mining Engineers', this being an excellent account of the iron deposits of Huacravilca by Señor E. I. Dueñas. The same system prevails in Chile, in the Argentine, and in Spain. It is a commendable idea; the technologic branches of the government are thus kept in vital communication with the workers in the field, while at the same time the technologists are kept mobilized for co-operative national effort, sharing the responsibility of administering the scientific bureaus. The superb service of our own Geological Survey, and of the Bureau of Mines, which was, so to speak, fashioned out of one of its ribs, leaves no room for criticism; the thought is suggested, however, that a closer organic relationship of the engineers throughout the country with such institutions might afford possibilities of inspiration both within and without the bureaus.

IT is reported that Senators Henderson, Walsh, and Jones called at the White House the other day to present reasons to President Wilson for opposing the passage of the War Minerals Bill. When it is remarked that these gentlemen represent respectively the States of Nevada, Montana, and New Mexico, we may shrewdly guess the cause of their anxiety. The copper producers,

at least some of them, appear to believe that this particular war-emergency legislation is capable of being interpreted to include the major non-ferrous metal industries. If they honestly hold that opinion the proper thing would be to ask their friends in Congress so to amend the Bill as to restrict its application beyond all doubt to the metals and minerals specifically mentioned. No one will object to that, for we want to ensure a sufficient output of manganese, tungsten, chrome, sulphur, pyrite, and other essentials to sustain our war industries in the most efficient manner. Mere opposition to the passage of the Bill, the defects in which might be cured so readily with full consent of its sponsors, is difficult to explain. Either the Government must become the producer, or the individual producers must have adequate guarantees to cover the capital expenditures necessary for mining these substances, if the War Industries Board is to escape a serious shortage. The pending Bill is the fruit of serious consideration by those most competent to determine what branches of the mineral industry required subventioning. To block these efforts is playing into the hands of the Enemy.

THE British government has arranged with the United States Treasury Department for rupee credits in New York at the rate of 35.73 cents per rupee for telegraphic transfer. This places American merchants on exactly the same basis as commercial houses in England with respect to rupee exchange. Nearly the whole of the silver coin so far melted under the Pittman Act has been exported to India in liquidation of a trade-balance between that country and the Western nations. The melting of the coin is limited to the corresponding silver certificates offered for redemption. The quantity turned in had amounted to $64,000,000 on July 10. This is smaller than had been anticipated, but it has served the double purpose of relieving an acute financial strain in India, and of protecting the American silver producer by an assured market at $1 per ounce. The total silver output of the United States in 1917 was 72,244,500 fine ounces, so that the silver the Secretary of the Treasury is required to buy in order to replace the coin melted under the Pittman Act is already in excess of the half-year's production. The new Federal Reserve notes, in $1 and $2 denominations, that are to be exchanged for silver certificates of like amount, are not yet ready for issue; the exchange has been effected in bills of $5 in value or higher. The returns, however, have been slow, and special efforts may be necessary to induce the people to deposit the certificates in the banks. The Treasury still holds 426,000,000 silver dollars, against which $381,806,776 in silver certificates remains outstanding.

SOME years ago an attempt was made to prepare a Blue Book of Mining Engineers, a sort of Burke's Peerage or Debrett's Baronetage of the profession. The scheme fell flat; it was killed by ridicule, as it deserved. Now we hear from our brethren in the East, where wisdom flourishes, that an Academy of Engineers is to be organized, a sort of House of Lords of the profession. The idea has been presented officially to Mr. W. C. Redfield, the Secretary of Commerce, and on his initiative a bill was passed by the Senate in July 1917 to create an American Academy of Engineers, to be organized by ten engineers, who, in turn, are to name forty more. To these fifty select persons is to be given the power of adding 50 or 100 more, whereupon the organization becomes a closed circuit, no further additions being permissible except on the death or resignation of the elect, when the survivors are empowered to fill their ranks. The bill passed the Senate unopposed, because the attention of the profession had not been attracted to it by any publicity. Since then various engineering societies have heard about it, most of them taking steps to denounce the establishment of such a body and instructing their officers to communicate their opposition to members of the House, where the bill now rests. We are glad to learn that the Engineering Council, when asked to help in securing the passage of the charter through Congress, referred the matter to a committee, which has decided almost unanimously to oppose the scheme. Four out of five of that committee are on the list of the proposed Academy. As the Engineering Council represents four engineering societies numbering 30,000 members, it is to be hoped that this action by its committee will prove sufficient to block the attempt to imitate the outworn snobbishness of Europe.

The Testing of Men and Ores

If anything were needed to prove that it is character that makes a man, not education, the proof could be found in the diversities of origin and of training from and through which distinguished members of our profession have come on their way to a successful career. Some of them have stepped from scientific colleges or universities as fully equipped as academic study could make them; others have had not even a full course in common schools, and have been compelled to earn their living while their competitors were still undergoing a technical training. The race is not to the swift, but to the persistent; it is not to the smart, but to the wise. Character and circumstance appear to be the two determining factors. The strong character steers amid the shoals of circumstance to the open sea of opportunity; the weak character drifts upon the bank and is wrecked by the first unfavorable wind of adversity. Fortune favors the brave; good luck betides the persistent. Such are the ideas suggested by the interviews with distinguished engineers that we have published and by the one that we publish this week. The subject of our latest interview is widely known for the mechanical devices bearing his name and invented by him; he is also one of those fortunate men who have friends scattered all over that generous kingdom we call the mining world. John M. Callow was born a farmer's son, but the farm was within sound of the North Sea, and to him as to other young Britons from time immemorial the call of the sea was the réveillé

of adventure. He had no wish to stay at home on the farm, he wanted to become an engineer, and as an engineer to make a career for himself in a wider world outside the little village in which he was born. While yet a boy he sailed for Australia and visited the old gold-mining districts in Victoria and afterward the newer mines of Queensland, where he had his first experience as a mill-man. It was a mere taste of engineering, but the voyage was an education to mind and body. He returned home and completed his training with the local firm of engineers to whom he was apprenticed; but he could not stay in Norfolk; always there was the voice of the sea and the call of the wide spaces. He went to Colorado. Not yet physically strong enough to follow his bent, he applied the art of engineering to the improving of land, and prospered, both in pocket and in health. He left the farm for the draughting-room and soon thereafter demonstrated his intelligence in the selection of a wife. Early in his career he became associated with resourceful men, whose stimulating goodwill he was quick to win. A little mining and milling in the mountains of the San Juan added several more pages of useful experience; and then came the larger opportunities for designing mills offered by that energetic mine-promoter, Mr. Samuel Newhouse, and that experienced mine-manager, Mr. Thomas Weir. For these gentlemen Mr. Callow made milling-tests, suggested flow-sheets, and designed plants. Becoming "tired of panning," he built a miniature Wilfley table for making his tests on the Highland Boy ore. That little concentrating-table proved so useful that he made copies of it, and sold them, sending them all over the world. On the ground-floor of his ore-testing establishment the original is still to be seen, together with the accessories, from which he developed the idea of a central plant for testing ores as a preliminary to building mills. This plant is now well known, and it is noteworthy that, as he went home to find a wife, so also he chose two school-boy friends to be his partners in business. He designed the cone, the screen, and the tank that bear his name, proving his restless ingenuity, and in later days he introduced the froth-making machine that has made him famous, for wherever flotation is practised there the Callow pneumatic cell is known. It is to be regretted that the exigencies of litigation—not his own legal quarrels, but those of others—prevent him from talking freely on flotation, a branch of metallurgy to which he has made sundry notable contributions. However, the interviewer was able to elicit a few observations, all of which will be found interesting. The way in which he developed his ability as a draughtsman to the designing of new machines is a tribute to his engineering apprenticeship and also to his concentration of mind. He could concentrate thought in his head as he could concentrate chalcocite on his little Wilfley table. As a school-boy he took little part in sports, probably from lack of physical exuberance; instead, he invested his pocket-money in a lathe, to which he devoted the time his fellows gave to cricket. Besides originality, he has the saving grace of being willing to listen to constructive criticism. Impulsive by temperament, he can make enemies, but not nearly so fast as he makes friends, and he holds them, for loyalty is one of his traits, also kindliness. Many are the young men to whom John Callow has given a helping hand, in the way of advice or something more substantial. So say those that know him best. That is worth more than a gold medal.

The Financial Safety-Valve

In 1917 the United States exported about 790,000,000 pounds of refined copper, to which must be added 15% more for copper in other merchantable forms. We sent abroad 370,000,000 pounds of brass as bars, plates, sheets, and scrap, and $280,000,000 worth of brass manufactures. These items do not include the copper and brass constituting parts of machinery and other goods shipped to Europe. In 1917 our cotton crop amounted to 12,300,000 bales and we exported over half of it. England took approximately 3,500,000 bales, France 600,000, and China nearly the same quantity. In addition to that we sent overseas nearly $150,000,000 worth of cotton goods. These examples of the movement of trade serve to remind us that our Government, in spite of its extraordinary military requirements, is not by any means absorbing all the commodities we produce. Also it must be noted that the Liberty Loans represent in large part a national asset; over two-thirds of the amount of these bonds to date is covered by advances to our Allies. In one aspect of it the people have been subscribing heavily to foreign loans, guaranteed by our Government. Broadly considered, these are World Liberty Bonds, and back of them stands the credit of the United States, and England, and France, of Italy, Belgium, Serbia, and Greece. The total issues are approximately $8,000,000,000 and the amount loaned abroad is $6,380,040,000. This investment is destined to give us great financial strength in the days after the War. The balance of trade in our favor last year was $3,273,789,699, and part of that was absorbed in transactions outside the settlements made through warrants for account of our Allies issued against the U. S. Treasury. It was represented by purchases of bills of exchange on London through the American agents of the Bank of England. When we ask where our supplies are going, the answer is not merely that they are going into the great sink of war but that a large part of them is entering into the structure of credits that are adding to the banking resources of our country. When prophets of evil croak of an impending financial crisis, they should be asked to explain this significant fact. We are not now discussing the financial position of our Allies; they have fought bravely, and as bravely have pledged their faith to pay these stupendous sums. America has been a generous lender; her sons now are brothers in arms with those of France, England, and Italy; she is certain to be a generous creditor in the days of reconstruction. It

is to the gain of England, France, and Italy that America should be financially strong at the end of the War. Germany hopes to see the rest of the world crippled, so that she may stand more nearly equal with her antagonists in a future commercial vendetta. In this she will be disappointed; America is full of vitality and will sustain her Allies until they recover from the shock of war. On the other hand, we must keep our poise; we must not suffer the high prices of an era of strife to trouble our thoughts with notions of change in the foundations of our monetary system. Gold was at a premium after the Civil War; it has gone to a premium after all great wars in modern times, but it is worthy of note that a larger proportion of the available gold was then in the possession of the people than will be true after the present war. That fact makes a great difference. The possibilities of the credit system may be said to have been discovered since the Civil War. The theory of it dates far back in the history of finance, but the utilization of the principle was on a pigmy scale compared with the gigantic acceptance of commercial paper in recent years, without conscious thought of the gold in terms of which the sums involved in these transactions were measured. The closer drawing together of the nations by steamship and cable communication, by the adoption of similar methods of doing business through banks and bourses, and by treaties establishing international rights and equities, thus creating trust and confidence in international commercial methods, have made possible an enormous expansion of the credit system, with which the output of gold could not keep pace. With mutual faith between the nations, with reliance upon the stability, justice, and honor of the governments themselves, the need of the actual gold was less appreciated. The credit represented goods or valuable services, therefore it in no wise resembled fiat money. It was wholly different from the greenbacks that a verdant political party once thought the Government could issue by the millions to serve as currency. Greenbacks of that kind are not currency, for they will not flow in the channels of trade; they are airy nothings, possessing only a flimsy value, which men instinctively discount, because they are a promise to pay without substantial resources behind them. A hundred greenbacks might pass for a dollar, on faith, but the dollar of reference must be gold or a credit for something worth the dollar that will be acceptable in the market. In consequence of the firm belief that men will recognize the obligation indicated in the credits recorded in the banks, that they will deliver the goods or render the services of equivalent worth on demand, and because of our certainty that democratic governments are not of the kind that may be dissolved by sudden tides of revolution such as have overwhelmed the autocracies of the past, the actual employment of gold was necessary only in relatively small amounts for the settling of international balances. It was enough to know that the government held the coin; that it was guarded more safely than the individual could guard it, but was to be had at any moment, if desired, on the presentation of accredited demand-money. This is the condition today. Though the exportation of gold is prohibited, that circumstance only increases the surety that it cannot get beyond reach; the people are protected. There are Federal Reserve notes in circulation of a face value of $1,711,411,695, for every dollar of which, if any holder wish, he may demand and receive gold at any National Bank, or at any U. S. Mint. There are $704,137,008 National Bank notes outstanding, redeemable in gold at the pleasure of any one who possesses them. Including gold and silver certificates, United States notes, Treasury notes of 1890, silver dollars and subsidiary coin, the redeemable currency of the United States amounts to $4,277,266,666, or a little over $40 per capita. It is interesting to compare this with the redeemable currency of only $10 per capita in 1879. The total gold in the country at that time was barely $6 per capita; today it is $39.50. Who cares for the actual coin under such conditions? We are used to the credit system; our Government is strong and tried; we are content that the gold should be where it is, and as there is no trading in the metal in the open market our credit-money holds its exchange-value unimpaired. If this condition persists gold will not go to a premium. The dentist, the jeweler, can obtain what he needs from the mint; no higher market-price than $20.67 per ounce can anywhere prevail. Accordingly the financial world remains secure against the catastrophe of a demoralized currency. The credit system protects the monetary unit from being misused by the financial jugglers. It is a different thing to juggle with prices, for exaggerated market-values are closely related to expanded capital accounts, and inflated prices will revenge themselves on such capital as gold allowed to go to a premium has never done. Inflated capital, representing augmented investments during this era of increased prices and profits, will revert toward the normal under the reaction to lower prices in the days of reconstruction. It is the indebtedness contracted during such a period that will pinch in the future, and we see that the Government is preparing to cover its own needs largely by taxing excess profits rather than fixed incomes; it is resorting to loans for only the lesser part of its funds. The estimated expenditure from our entrance into the War to the end of 1918 is fifty billions of dollars. Of this sum sixteen billions will be represented by loans, and seven billions of that will consist of credits to our Allies, constituting a basis for industrial expansion in the future. A change in the official value of gold would reduce the purchasing power of that credit, and weaken our financial strength in proportion. This would seem to dispose of the proposition to alter the quantity of gold in the unit of exchange, or, as some have expressed it, to pay more for gold than $20.67 per ounce. We may if we choose, pay a bonus temporarily for new gold produced, but to tamper with the gold standard as now established would be equivalent to discounting the obligations created in the course of international trade, for these constitute a financial safety-valve ensuring stability after the War.

Democratic Control of Industry

The Editor:

Sir—It seems to me that the issue mentioned in the address of Mr. Channing and the letter of Mr. De Kalb is a very important one and worth further discussion by engineers and employers. Mr. Channing, as I recall it, praised some aspects of the much-quoted peace program of the British Labor party. Mr. De Kalb's chief objection to such a democratic control of industry was that an "elective absolutism" such as the proletariat would set up, where equalizing mediocrity would rule, would not encourage the development of the highly specialized types of men that the modern world requires. Engineers should be interested in such a suggestion, for they are highly specialized workers, as should employers, who seek and use men of exceptional development. We have read of the naive proposals of the Bolsheviki at the Russian mine that proposed to take turns at the engineer's job, while he took his turn at shoveling, in order that everyone might have a chance at the easy job, as the workmen saw it, of sitting in an office and sharpening pencils.

Adam Smith, the Scottish economist of the 18th century, showed that a nation's wealth is increased to best advantage when men are spurred to useful effort by letting individual initiative and spontaneity have the maximum freedom and reward. The wonderful development of the railroad industry in our country was the consequence of the throwing open of a free field for able daring men to go as far as they liked. Ultimately this principle of *laissez faire* was overdone, and a number of railroads became bankrupt through the eagerness of the financiers in control to work their individual will as they pleased. The attitude of specialized business-men and professional men toward what they consider meddling by semi-ignorant governmental committees is illustrated by the responses of Mr. Ingalls to the Congressional members, as printed in your issue of July 6.

Carlyle, who was an extremist, but is valuable as an antidote, urged hero-worship of men of genius and exceptional talent, in order to promote capable and inspiring leaders for leavening the dull lump of democracy. While his ideas are not entirely practicable, many other far-seeing men have advised the American people to give genius a chance, to encourage great men, and to sympathize with highly specialized workers who are in a position to benefit the country. A great nation has been defined as one that develops great leaders.

The issue between Mr. Channing and Mr. De Kalb seems to be whether, under a democratic control of industry, such as the British Labor party proposes, there would be encouragement and flexibility for developing highly specialized types. Would individuals perfect themselves by long years of study and adaptation for positions that promised only mediocre rewards? Would an "elective absolutism" have the foresight and tolerance to assist men of ability and imagination to spend their lives in non-standardized effort? Adam Smith proved that individual selfishness benefited the community. Will talent flourish without the individual selfishness that the reformers would banish?

P. B. McDonald.

Boulder, Colorado, July 13.

What is a Dollar?

The Editor:

Sir—A dollar is commonly believed by many to be a certain exchange-value or purchasing power which requires so much of this, that, or the other thing to equal; it seems difficult to describe this notion exactly, but, in the minds of all of us, there is a well-defined idea of what a dollar is worth. Nowadays, it is seen usually in the form of silver or paper. At least such are the forms that are commonly considered to be a dollar; but neither, in fact, is a dollar; the silver piece is a substitute for—and the paper bill is a promise to pay—a dollar.

To digress for a moment: In considering this general subject, it must be borne in mind constantly that all values are relative and that for the purpose of convenience and simplicity it is customary to express values in terms of a unit of value, which has been decided upon for that particular purpose. The word 'price' is used particularly to express the worth or exchange value of anything in terms of the unit of value.

A unit of value is a certain weight of a standard of value. Gold is the standard of value used by most of the nations of the world, and in the United States of America it is nine-tenths pure (or 900 fine, as commonly described); that is, standard gold is an alloy containing 90% pure gold.

The unit of value in the United States consists of 25.8 grains of standard gold, which contains 23.22 grains of fine or pure gold, and this has been called a 'dollar'. A dollar, therefore, is a definite weight of a particular commodity; it is 23.22 grains of pure gold. All other so-called 'dollars' are simply substitutes for, or promises to pay, a dollar.

There are some who are disposed to object to the term 'commodity' as applied to gold; but since, in its crude state and even when made into money, it is invariably sold by weight, it is to all intents and purposes a commodity. The fact that it is used as money has, of course, increased its use enormously and thereby added to its exchange value, but it is a commodity nevertheless. The fact that the Government has stamped symbols or designs on our gold coins adds nothing whatever to their exchange-value; such symbols are, simply, the Government's assay-certificate, certifying to the weight and fineness of each coin.

In further elucidation of what constitutes a 'dollar', let us consider the gold coinage of another nation, Great Britain, for example. The British coinage law requires that twenty pounds Troy of standard gold shall be divided into 934½ parts, or pieces, each of which is called a sovereign, or pound sterling. Twenty pounds Troy weight of standard gold is 115,200 grains, which, divided by 934½, gives a quotient of 123.2744+ gr., and, as the British standard gold is eleven-twelfths fine, each sovereign contains 113.0016+ gr. of pure gold. If a sovereign (113.0016+ gr. of gold) is divided by a dollar (23.22 gr. of gold) the quotient is 4.8665+; in other words, a sovereign is 4.8665+ dollars. It is commonly said to be worth $4.86+, but it is 4.86+ dollars, and being 4.86+ dollars, it must, of course, be worth 4.86+ dollars. To emphasize this point still more; 113.0016+ gr. of gold is 113.0016+ gr. of gold, whether it is called a sovereign, or pound sterling, or four dollars and eighty-six cents.

The so-called silver dollar is not truly a 'dollar', because it is another weight of another commodity; instead of being 25.8 grains of standard gold, it is 412½ gr. of standard silver (nine-tenths fine), or 371¼ gr. of pure silver. At present quotations, silver is one dollar per ounce, which means that 23.22 gr. fine gold is exchangeable in the market for 480 gr. fine silver; and as there are 371¼ gr. fine silver in the so-called silver dollar, the silver in that dollar is exchangeable in the market for $\frac{371.25}{480}$ of 23.22 gr. of gold, or 17.96 gr., and since a dollar is 23.22 gr., 17.96 grains are 0.7734 dollar, or 77.34 cents. Hence, the market-value (bullion-value) of the silver in a silver dollar is 22.66c. less than a dollar. But, when the Government issued a silver dollar to the people, it received from them 23.22 gr. of gold, or its equivalent, in exchange for it; therefore, it maintains the exchange-value of a silver dollar, as money, at a parity with a gold dollar. In issuing these silver dollars, the Government as a matter of fact sold the silver to the people at $1.2929 (30.01+ gr. of gold) per ounce—the coinage value of silver.

It has been stated recently, in the columns of the local press, that this silver cost the Government an average of about 72 cents (16.7184 gr. of gold) per ounce. If that statement is substantially correct, this difference (called seigniorage) amounted to about 57c. per ounce of silver, equal to a little more than 44c. on each silver dollar. The seigniorage, however, was placed in the Treasury as an unappropriated balance for use by the Government.

At the present quotation, 480 gr. of silver is exchangeable in the market for 23.22 gr. of gold; which means that the ratio of silver to gold is 480:23.22, or 20.67 + :1.

Should silver, instead of gold, be made the standard of value, and should 23.22 gr. be called a 'dollar', then an ounce of silver would be 20.67 dollars and, at today's ratio between silver and gold, an ounce of the latter would be worth 423.25 dollars (20.67 times 20.67 gr.).

At four dollars gold for eight hours' labor, a workman is paid today 92.88 gr. of gold, or its equivalent; or 20.67+ times that weight in silver, which is 1920 gr., or four ounces. If, instead of gold, 23.22 gr. of silver is made a 'dollar', he would receive, at the same wage (1920 gr. ÷ 23.22 gr.) 82.68 dollars per eight hours. But, other things being equal, the 82.68 dollars would be exchangeable for only as much food, clothing, etc., as is now obtainable for four dollars in gold, because all commodities would rise in price in direct proportion to the decrease in the commodity-value of the silver 'dollars' as compared with the present gold dollar.

Again, should any other metal, such as lead, be taken as the standard of value, in place of gold, and 23.22 gr. be called a 'dollar', then, as before, a Troy ounce of lead would be 20.67 dollars. A pound avoirdupois, 7000 gr., would be (7000 ÷ 23.22) 301.46 dollars. The ratio of lead to gold at the present price of lead, 7c. per pound (1c. for 1000 gr.) is 1000 to 0.2322, which is 4306.6:1. At this ratio, an ounce of gold would be worth (4306.6 × 20.67) 89,017.42 lead dollars.

In conclusion; as long as the unit of value is a dollar, or 23.22 gr. of gold, an ounce of gold, 480 gr., is (480 gr. divided by 23.22 gr.) 20.67183+ dollars and, as the 'price' of anything is its exchange-value in terms of the unit of value, the price of gold will be 20.67183+ dollars per ounce; in other words, the price of an ounce of gold is an ounce of gold.

It has been stated that, at a recent conference with the Director of the Mint, someone suggested raising the price of gold to $30 per ounce, to help the gold-miner! Thirty dollars is 30 times 23.22 gr. of gold, or 696.6 gr., and the literal meaning of such an act is to pay 696.6 gr. of gold for 480 gr. of gold. This suggestion is a pertinent illustration of the fact that one, at least, of our metal-producers did not realize that a dollar is not a certain purchasing power and that it is, instead, a certain weight of a commodity (gold) that has a constantly varying purchasing power.

As it is impracticable to induce the Government to pay 696.6 gr. of gold for an ounce, 480 gr. of gold, an alternative would be to induce it (the Government) to call 16 gr. of gold a 'dollar'; then an ounce would be $30. This act would make the exchange-value, or purchasing power, of the new gold 'dollar' thirty-one and a fraction per cent less than that of the present dollar. But if this were done, what would happen in the commercial

world? Talk about earthquakes! But, with Kipling's permission, that is another story.

W. DE L. BENEDICT.

San Francisco, July 22.

The Relation of Gold to War Finance

The Editor:

Sir—The attention of the Treasury Department of the United States, of members of Congress, and of the bankers of the country, has recently been called to the serious situation in which the gold-mining industry of America and of the world finds itself in consequence of the increased cost of labor and supplies resulting from the War, and because of the fact that the value of the gold produced, being fixed in price by the Government, therefore enjoys no increase in its market-value. By far the greater quantity of gold now produced necessarily comes from low-grade deposits, in which the margin of profit, even in normal times, is comparatively small. This is true because of the unusual manner in which gold occurs in nature. While it is widely distributed, it is found, as a rule, in minute quantities. High-grade deposits, resulting from unusual concentration, in the nature of things, are rare. In addition to this, the high-grade deposits usually are the first to be found, mined, and depleted. The active and persistent search for gold in the past has resulted in complete knowledge of its occurrence, and in the discovery and exhaustion of the richer deposits; those engaged in the industry and familiar with the habit of gold deposits are agreed that the future of the gold-mining industry and of gold production in the world is now and will hereafter be dependent mainly upon low-grade deposits. Taking this into consideration, as well as the present fixed value of gold and the rapidly rising cost of material and labor, it is obvious that the existence of the entire industry, as now developed, is threatened.

This condition has been developing for the last four years and it has become so acute that the production of gold from the majority of the low-grade deposits is now being made at a loss. Last month 300,000 oz. of gold, produced on the Rand, which is the most productive gold-mining region in the world, was sold to the Government at less than cost, and the same thing is true of several of the largest properties in Alaska, Canada, and the United States. It is inevitable that, unless some form of bonus is given to the producing mines, or an actual increase in the value of the product itself is made by the countries in which gold is now being mined, the large producers will be compelled to discontinue operating and the already decreasing production of gold will be most seriously affected. It is obvious, likewise, that the estimated profits on ore, based on pre-War conditions, on which these enterprises were established, have ceased to exist. Tonnages of developed ore in the mines that were carried as an asset because profit was indicated on the pre-War basis, must be entirely written off under present conditions, and only the richer ore in the operating mines can be carried now in the form of a reserve. In other words, no low-grade gold-mining operation conceived, financed, and developed under pre-War conditions can possibly work out as originally planned, nor can it hope to continue for any length of time unless a bonus is offered by the Government to compensate for the increased operating costs, or unless the value of the gold, as fixed by the Government, is materially increased.

The question, therefore, that presents itself is whether the production of gold is a necessity and whether gold mining is an essential industry. In order to determine this, some of the operators in Alaska, through Mr. Charles Sulzer, the Congressional delegate from that Territory, raised this question with Mr. William McAdoo, Secretary of the Treasury, who, in a letter addressed to Mr. Sulzer, dated June 10, 1918, clearly and forcibly defined the position of the gold-mining industry as next to that of the production of food and ammunition, pointing out at the same time the necessity for increasing the gold reserve of the country to sustain the great structure of credit now being developed in order to finance the War.

The use of gold as the basis of credit and exchange has been so firmly established, it has proved so universally satisfactory, its occurrence in nature, and its physical and chemical characteristics are all such that it may be stated positively that no other commodity compares with it for this particular purpose, and there is no other likely or possible substitute; neither will there be so long as there are separate nations and governments on the face of the earth. All balances in international trade must be paid in some fixed and unchangeable medium like gold. Nations will not accept the paper of other countries in payment for credits unless backed by a proper gold reserve, and, as a rule, they will not accept payment except in gold itself. The necessity for finding a fixed basis for credit became pronounced as international trade developed to large proportions. The first country to adopt gold as the sole standard of values was England and this was later accepted and adopted by all the principal nations of the earth.

One of the most important and interesting questions arising in this discussion is the value of gold as now fixed and accepted by the leading nations of the world. The price of pure gold in our standard of money is fixed at $20.67 per ounce. This value was arbitrarily fixed by the Bank of England when England decided that it was advisable to fix the value of gold in order to standardize exchange. Prior to this, while England had adopted gold as a standard, she had been in the habit of purchasing gold in the open market at a variable range of prices. This necessarily affected, from day to day, and from purchase to purchase, the very basis of exchange. Hence the necessity for establishing a fixed price.

It is generally conceded that the price as fixed was taken from the last purchase of gold made by the Bank of England in the open market. This, in our money, as stated above, happens to have been $20.67. Shortly after this, the other leading nations accepted that gold stand-

ard, and likewise the price that had been fixed arbitrarily by the Bank of England and sustained with the approval of the British government. The important fact regarding this, so far as the present discussion is concerned, is that the price as fixed was purely arbitrary. Even if measured in the currency of the time at which this occurred, when gold was estimated to be worth $20.67 per ounce, it is evident that the great increase in the demand for this product and the increased cost in producing it, makes this valuation now incorrect and decidedly too low. Accepting gold as a basis of all credits, there has never been a period in the history of the world when the demand has been so great as now, in order to sustain a reasonable reserve against the Government issues of bonds, certificates, and other forms of obligation.

E. M. Patterson of the University of Pennsylvania, discussing our national financial situation, points out that "although the amount of gold held by the Federal Reserve banks has almost doubled, the ratio of gold to net deposits and Federal Reserve notes combined, has fallen in the past year from 83 to 61%." The quantity of gold coming into the United States, and now held by the United States, was doubled because of the tremendous quantities of war materials and supplies sold to foreign governments that had to be paid in gold; in consequence, this gold, heretofore held in reserve by England, France, and other countries, found its way to this country.

It is unlikely that this condition will continue, now that we have entered the War, for our large armies in France require huge expenditures and purchases made in foreign countries that must be settled in gold; and, as Mr. McAdoo has pointed out in his letter to Mr. Sulzer, we are, at least for the time being, compelled to pay for our purchases from neutrals in gold because we require all of our own supplies and therefore have no balance of trade with them. Considering this fact and that the productive gold mines of the country will be compelled to discontinue operations unless assistance is given, it can be seen that the gold reserve held by the United States, because of the necessity of additional issues of new bonds, certificates, and other paper, in order to finance the War, will suffer a further and material decrease in the immediate future. As a matter of fact the United States is paying out today gold to neutrals for purchases at a fixed value considerably less than the cost of producing it.

The international phase of this question apparently has been overlooked; it has a direct and important bearing on the War itself. As pointed out by Mr. Hennen Jennings, consulting engineer to the U. S. Bureau of Mines, 91% of the gold and the chief gold-mining districts of the world are owned or controlled by the Allies —France, England, and the United States. Approximately 1% only is owned or controlled by the Central Powers, and 9% is in the hands of neutrals. This is not alone an interesting fact but one that, if properly utilized as a war measure, can yield a great advantage to the Allies in affecting the credit structure of the Central Powers.

It is well known that the issue of paper credits by the Central Powers to their own people and to the adjacent neutrals has been necessarily in far greater proportion to their gold reserve than in the case of the Allies. So long as these countries are dealing among themselves only and are unable to engage in international business, and just so long as their governments remain strong enough to compel the peoples of the Central Powers to accept such paper on its face value, their actual gold reserve is not important; but the instant the War is ended, and the Central Powers are again compelled to enter foreign trade in order to replenish their exhausted supplies of material, their paper-credit will have to be maintained by a gold reserve, else it will fall to pieces, causing a tremendous financial disaster. The German financiers are aware of this, but expect to build up their gold reserve through their ability to sell material and supplies in the world-market at a less cost than they can be produced in the Allied countries. There is grave danger that this condition will actually develop so far as this country and the Allies are concerned, because one of the results of the War has been greatly to increase the cost of labor, that is, labor has demanded, and received, much higher wages, approximating 100% above the average before the War. As a net result the cost, in gold (in the United States at least, and, to a lesser degree, in England and France), of producing commodities, has increased approximately 100%. Pig-iron is selling at $33 as against $15 before the War, and the cost of almost every other important commodity has risen in like proportion. The danger from this lies in the fact that the Central Powers, and Germany in particular, have not increased the wage-scale in like proportion; so that the cost, measured in gold, of producing all articles in Germany after the War, or even now, is less than it is in this country—very much less. The German financiers have boasted of this repeatedly. It amounts to the same thing, on the part of Germany, as placing a premium on our gold supply, such premium being equivalent to the difference in the average cost of labor between the Central Powers and the United States and her Allies.

While tariffs and trade agreements may be developed and arranged to offset this difference in some degree, the easiest, the most sensible, the most practical, and the quickest way to place German labor and industry on a parity with that in the United States and the Allied countries, will be arbitrarily to increase the value of gold in an amount sufficient to offset the average difference in wage-scale existing between the Allies and the Central Powers at the present time. This is possible only because of the conditions mentioned before, namely, that 91% of the gold and of the gold-producing mines of the world are controlled by the Allies, and less than 1% by the Central Powers. It is evident that the governments of the Allies that control this gold resource would have to do twice the amount of work and sell twice the quantity of material in order to obtain the gold supply necessary

to establish a proper reserve against the paper-credit structure that has been developed by them on account of the War. In other words, the governments of the Allies would compel Germany to pay twice as much for her necessary gold supply.

It has been argued that such change in value of the basic metal, gold, would derange the structure of credit, but this can be obviated by agreement between England, France, and the United States, the countries that control the gold supply of the world, and also by suitable legislation in their respective countries.

It would be necessary, of course, first for the governments not only to withdraw all gold coinage and hereafter command the entire existing supply, also to command all the gold to be produced in the future. In a large degree this has already been done, as gold coins are rapidly going out of circulation. The issue of the Federal Reserve certificates is an illustration of what would take place in lieu of the issuance of gold coinage. It would not derange the value of the gold currency as issued, because it is apparent that the value of gold behind this currency is in any case arbitrarily fixed by the Government. For instance, if the governments arbitrarily agreed that gold should be fixed at $40 per ounce instead of the present fixed price of $20.67, the owners of certificates or bonds will receive half as much gold as they would now receive in redeeming their paper; but if half an ounce of gold is worth twice as much as it is now worth (and this would be the case) there would be no actual derangement or change in the value of the currency of paper issues. In other words, half an ounce of gold worth $40 would be just as satisfactory to the holder of paper as an ounce worth $20.67, because in both cases the value itself would be fixed arbitrarily by the Government. Moreover, this value would be more in keeping with the actual value of the gold as produced.

Fineness has to do only with the purity of gold. The fixed price of $20.67 per ounce, as now established, refers to pure gold only. Gold of less fineness than pure gold is obviously worth less than $20.67 per ounce in proportion to the quantity of other metals contained therein. For instance, in the $20 gold piece as now issued, there is not quite an ounce of pure gold, the difference between the $20 and the $20.67 consisting of copper added for the purpose of making the coin harder and more serviceable.

While my suggestion may seem radical, it is interesting to note that the gold-producers of the British Empire called a meeting on July 4 and appointed a committee of six to bring such a proposal before the British government.

So far as the United States is concerned, the first and immediate necessity is legislation that will permit the continuance of the present gold-mining industry. This can be accomplished temporarily by establishing an adequate bonus sufficient to offset the increased cost of labor and materials. A second step would be the formation of an international commission to act jointly with the committee now formed in London and with proper representatives of the governments for the purpose of re-establishing a fixed price for gold commensurate with present conditions, and finally, the enactment of such legislation as will protect all paper issues that have been made on the present gold basis, and the taking of such steps as are necessary to see that the international gold assest controlled by the Allies is properly used in order to place the Central Powers on a parity with us so far as the cost of producing material is concerned. In this way they would be prevented from drawing out the gold supply of the Allies through neutrals by selling materials in the world-market at a lower gold cost.

It is to be hoped this discussion may lead to immediate legislation to protect the gold-mining industry of the Allied countries and take full advantage of the control of this metal by them, in dealing with the credit structure of the Central Powers. Given the knowledge and the fact that the United States and her Allies actually control 90% of the gold and gold-producing areas of the world the questions arise:

1. Why should we continue to pay for supplies purchased from neutrals in gold at less than the actual cost of production?

2. Should not the United States and our Allies immediately recognize this great international asset and take all necessary steps to prevent Germany and the Central Powers from entering the world markets, and thereby draining from the United States and her Allies the gold with which to preserve the paper-credit structure that had been developed for the purpose of carrying on the War against us?

3. Why should the gold-mining industry, as established, be compelled to sell its product at a price less than that which it is actually worth?

B. L. Thane.

New York, July 18.

Cooperite is a new high-speed alloy developed in England. It is said to be an alloy of zirconium and nickel. It has a bright silvery lustre and a specific gravity much lower than other alloys used for high-speed work. Cooperite contains no carbon or iron, and, consequently, is not a steel. Its melting point is only about 1150°C., and owing to the fact that the alloy remains in a liquid state for a considerable period before solidifying, difficult castings can be made with ease. No heat-treatment is said to be required, the hardness being varied by changing the proportion of the constituents. Cutting tools have been produced with a hardness of 250 up to 500 Brinell, the latter still retaining sufficient toughness to withstand heavy roughing cuts.

The Parker rust-proofing process consists in cleansing the iron or steel by sand-blasting, followed by pickling or immersion in Na_2CO_3; the object is then dipped in a solution of acid meta-phosphate of tungsten or molybdenum; and finally the metal is treated with a special oil, whereby a soft, black, dull finish is obtained.

Correction of Stadia-Readings to Horizontal

By E. A. BYLER

This table gives the corrections to be subtracted from the rod-readings for each hundred feet, from 100 to 900. The corrections for tens is obtained by removing the decimal point one place to the left; for units, two places to the left.

The table is accurate, and by interpolation the correction may be made within the limits of the decimal places given. However, for the usual purposes for which stadia-observations are used, such as topography or mapping, results to the nearest foot or possibly 0.5 for short readings is all that is desired and the corrections can be taken out quickly by inspection, without interpolation, giving results well within the limits of observation.

For moderate vertical angles it will be sufficiently close to take out the correction to the nearest 10 ft. of rod-reading and to the nearest vertical angle given, so that a mental addition of two numbers (for the tens and the hundreds) will give the correction to be subtracted from the rod-reading.

If desired to make correction for focal length, it may be made by adding to the result the focal length of the particular instrument without correction for vertical angle. This will be sufficiently accurate.

If the distances are long, closer results may be obtained by interpolating between the vertical angles given.

At 20° the correction for 5 ft. is but 0.6, so that it is seldom worth while to take out the correction closer than to the nearest 10 ft. of rod, unless possibly, in the case of very steep angles and short distances.

A little practice with the table will enable one to know at what point to make the interpolation in order to have the results within the limits desired.

As little calculation is necessary the table facilitates the quick reduction of observations.

Horizontal Corrections for Stadia Readings.

V. Ang.	100	200	300	400	500	600	700	800	900
1° 0′	03	06	09	12	15	2	2	2	3
2	12	24	37	5	6	7	9	10	11
3	27	54	82	11	14	16	19	22	24
4	49	98	15	20	25	30	34	40	44
5	76	152	23	30	38	46	53	61	68
6	109	218	33	45	56	65	76	89	98
7	149	298	44	60	75	89	104	115	134
7 30	171	342	51	69	86	103	120	137	154
8	194	388	58	78	97	116	136	155	175
8 30	216	436	65	87	109	131	153	174	196
9	243	490	73	98	122	147	171	196	220
9 30	272	544	82	109	136	163	190	218	245
10	302	604	91	121	151	181	211	242	272
10 30	332	66	100	133	166	199	232	266	299
11	364	73	109	146	182	218	255	291	328
11 30	397	80	119	159	198	238	278	318	357
12	432	86	130	173	215	259	302	346	389
12 30	468	94	140	187	234	281	328	374	421
13	506	101	152	202	253	304	354	405	455
13 30	545	109	164	218	273	327	381	436	490
14	585	117	176	234	293	351	409	468	526
14 30	627	125	188	251	314	376	439	502	564
15	670	134	201	268	335	402	469	536	603
15 30	714	143	214	286	357	428	500	571	643
16	760	152	228	304	380	456	532	608	684
16 30	807	161	242	323	404	484	565	646	726
17	855	171	256	342	427	513	598	684	769
17 30	904	181	271	362	452	542	633	723	813
18	955	191	286	382	477	573	668	764	859
18 30	1007	201	302	403	503	604	705	806	906
19	1060	212	318	424	530	636	742	849	954
19 30	1114	223	334	446	557	668	780	891	1003
20	1170	234	351	468	585	702	819	936	1053
20 15	1193	240	360	479	599	719	839	959	1078
20 30	1220	245	366	490	613	736	858	981	1103
20 45	1255	251	376	502	627	753	878	1004	1130
21	1248	257	385	514	642	770	899	1027	1156
21 15	1314	263	394	526	657	788	920	1051	1183
21 30	1343	269	403	537	671	806	940	1074	1209
21 45	1373	275	412	549	686	824	961	1098	1236
22	1403	281	421	561	701	842	982	1122	1263
22 15	1434	287	430	574	717	860	1004	1147	1291
22 30	1466	293	439	586	732	878	1025	1171	1318
22 45	1493	299	448	598	747	897	1046	1196	1345
23	1527	305	458	611	763	916	1069	1222	1374
23 15	1558	312	467	623	779	935	1091	1246	1403
23 30	1590	318	477	636	795	954	1113	1272	1431
23 45	1622	324	487	649	811	973	1135	1298	1460
24	1654	331	496	662	827	992	1158	1323	1489
24 15	1687	337	506	675	843	1012	1181	1350	1518
24 30	1720	344	516	689	860	1032	1204	1376	1548
24 45	1753	351	526	701	876	1052	1227	1402	1578
25	1786	357	536	714	893	1072	1250	1429	1607
25 15	1820	364	546	728	910	1093	1274	1456	1638
25 30	1853	371	556	741	926	1111	1297	1482	1668
25 45	1888	378	566	755	944	1133	1323	1510	1699
26	1922	384	577	769	961	1153	1345	1538	1730
26 15	1957	391	587	783	978	1174	1370	1566	1761
26 30	1991	398	597	796	995	1195	1394	1593	1792
26 45	2026	405	608	810	1013	1216	1418	1621	1823
27	2061	412	618	824	1030	1237	1443	1649	1855
27 15	2097	419	629	839	1048	1258	1468	1678	1887
27 30	2134	426	640	853	1066	1279	1492	1706	1919
27 45	2169	434	650	867	1084	1301	1518	1735	1951
28	2204	441	661	882	1102	1322	1543	1763	1984
28 15	2240	448							
28 30	2277								
28 45	2313								
29	2350								
29 15	2388								
29 30	2428								

E. A. BYLER,
GOLDFIELD, NEV.

Example

Vertical angle, 10°45′; rod, 575; focal length, 0.8.

18.2	Correction for 11° for	500
2.5	Correction for 11° for	70
20.7	Total correction for	570
575.0	Rod	
554.3		
0.8	Focal length	
550.0	Horizontal distance, nearest foot without interpolation	
17.4	Correction for 10°45′ for	500 by interpolation
2.4	Correction for 10°45′ for	70 by interpolation
0.2	Correction for 10°45′ for	5 by interpolation
20.0	Total correction for	575 by interpolation
575.0	Rod	
555.0		
0.8		
555.8	Horizontal as corrected by interpolation	
555.0	Horizontal as corrected without interpolation	
0.8	Difference (as close as rod can be read)	

THE PRODUCTION OF ELECTROLYTIC IRON in France, as a result of the scarcity of Swedish iron, has led the Firminy Steel Co. to install the Burgess process for the production of electrolytic iron at its Rioupéroux plant. The ultimate capacity of the plant will be 25 tons of electrolytic iron per day, at 50 francs per ton. The electrolyte remains fairly constant for a long time. Iron anodes, in a solution of ferrous ammonium sulphate, with a little ferrous chloride, are used. The current density is 1 amp. per square decimetre. The mean analysis of the Rioupéroux electrolytic iron is: C 0.015 to 0.064, Si 0.004 to 0.02; Mn trace, P 0.002 to 0.009, S 0.001 to 0.007%. For a detailed comparison of the various electrolytic-iron methods see Aimé Coutagne in the Bull. Soc. de l'Industrie Minerale, 1917, No. 3.

WHERE MR. CALLOW WAS BORN; A TYPICAL ENGLISH HOMESTEAD

John M. Callow—Engineer and Metallurgist

AN INTERVIEW, BY T. A. RICKARD

You were born in the old country?

I was born in the village of North Repps in the county of Norfolk, within sound of the North Sea.

At what date?

July 7, 1867.

Was your father connected with engineering?

No, my father was a large farmer and a land-owner, so that I was a farmer's son.

What was your early education?

The ordinary English grammar-school education until I was 16. Then I was articled as an engineer to a firm of engineers in the city of Norwich.

You supplemented your apprenticeship by further study, I presume?

I did, taking an engineering course in the Norwich School of Art, the South Kensington examinations in applied science. This entailed a great deal of study by night and my health suffered, so that our family physician advised my father to send me on a sea voyage. He bought me a ticket on a sailing ship for Australia and gave me a letter of credit for about $500. I sailed for Australia in the year 1885 on the sailing ship 'Superb,' which was one of the old Black Wall liners, and was originally an East India troop-ship. The voyage was full of experience for me, as we were two weeks beating down the English Channel to Plymouth, where I got my first 'sea legs,' and we were three and one-half months from Plymouth into Melbourne harbor.

Did you try to get employment?

Not at this time, as I still had some funds. I visited the mining camps of Ballarat and Clunes and saw my first mining. From there I went on a visit to Tasmania and stayed for some weeks at Triabunna Bay on the east coast, close to the old convict settlements of Maria island. From there I went to Sydney and afterward to Brisbane and the Darling Downs district; from there to Townsville and from there to Charters Towers, where I met a man from my own village.

Did he help you?

Yes; through his kindness, I spent some weeks on a cattle station on the Burdekin river among the Myall blacks.

You did not go to the mines at Charters Towers?

I visited all the principal mines at Charters Towers,, and I remember also, the small smelter at Ravenswood.

About this time, I was 'broke,' so I sought employment, and got a job in Plant's mill.

Do you remember the name of the mine?

No; my recollection is that it was a custom mill.

Probably the Day Dawn, for I can tell you that I met Mr. E. H. T. Plant at Charters Towers four years after the date you mention, by which time the Day Dawn had become a big mine. Mr. Plant was also a director of the Brilliant Gold Mining Co., which ranked first among the gold-producers of Australia. What was your job?

Just a roustabout around the mill. This was a small stamp-mill employing amalgamation followed by Berdan pans and Gilpin county bumping tables.

I doubt that. The Gilpin county bumping-table was not known in Australia at that time, but they had a machine called the Halley table, which needed a small boy to look after it; from our point of view, it was ridiculous in requiring the constant supervision of a small boy to remove the concentrate. Did you become interested in your work?

Of course. All this work was of much interest to me because of my training as a mechanical engineer. After working at Charters Towers for about two months, I received a welcome remittance from my father, with instructions to be sure to come home and finish my education. I had just enough money then to take a passage from Townsville back to England, this time in the steamer 'Dacca.' We called at Bowen, Thursday island, Batavia, Colombo, Aden, Suez, Port Said, and Malta. It was a wonderful voyage, lasting two months. The scenes and events were impressed on me indelibly. The 'Dacca' soon afterward went down in the Red Sea, but I landed safely at Tilbury dock on October 4, 1886, dressed in true Queensland fashion and with a miscellaneous collection of souvenirs, including boomerangs, spears, and a Maltese poodle. I went back to work with my old firm, Riches & Watt, at Norwich, staying with them until I was 21, by which time I had completed my apprenticeship.

So now you were ready to make a new start?

Yes; but having seen something of the world on my Australian trip, I was anxious to see more of it; therefore, on the first excuse, I sailed, in October, 1888, for New York, heading for Colorado, where I had relatives. My health still was none too good, and the doctors advised me to lead an open-door life for a time, so I went to Eaton, about 60 miles north of Denver, and, having a little money, I went into partnership with my cousin, as a renter on 80 acres of land—he to do the work, and I to furnish the money. We 'batched' in a tent in summer and a dug-out in winter. The venture was so successful that I decided to buy some land, and I bought 160 acres of raw land with water-rights from the Colorado Mortgage & Investment Co. and immediately went to work to improve it. Here I learned to ride, to drive a four-horse team, to plow, irrigate, and other rural accomplishments, and for two years followed the regular life of a farmer. I had this farm for 13 years, and it proved a successful investment. During my stay on the farm, I ran across Mrs. Mary Lease, 'the Kansas cyclone,' a political lecturer, and one of the main expounders of the Farmers Alliance doctrine. I accompanied her on her lecturing tour through that part of the State, and she influenced me to stop farming and go back to my profession, which she thought offered me a better scope. Shortly afterward, happening to be in Pueblo, I called on the Stearns-Roger Manufacturing Co. and met Mr. John Roger, who gave me my first job as a draftsman. I stayed there a year; then, the farm having been quite successful, I decided to go home. Before returning I was married to Miss Roberta A. M. More, whom I had long known and who was a sister of an old friend of mine, Thomas More, a pupil, like myself, of the engineering firm at Norwich. We settled at Denver, and I went back to work for the Stearns-Roger Manufacturing Co. in its Denver office in 1893. Here I first got acquainted with Mr. Stearns, and, I am proud to say, we have been good friends ever since. Unfortunately, the silver panic of 1893 affected the firm, as it did everybody else, so that they had to decrease their force, and I had to shift for myself again.

Yes, I know all about the silver panic, because it hit me in the same way. What did you do?

For a year I did practically nothing, except odd jobs as a draftsman around Denver, but in '94, I went to work for Mr. Philip Argall in the designing of the Metallic Extraction Co.'s works near Florence, Colorado. By the way, I also wish to say that on and off I worked for the late Henry Vezin, whom I held in great esteem, and from whom I benefited greatly on account of his wide technical knowledge. Here I may also record my many obligations to Mr. Argall, and the experience gained under his direction.

Did you have anything to do with the running of the metallurgical cyanide plant?

No. I left before the large plant was completed, and got into a mining venture in San Juan county, near Silverton.

What was the name of the mine?

It was owned by a company known as the Golden Horn, operating in Ice Lake basin, overlooking Ophir. Some of my English relatives and friends had put up the money. We built a mill and worked the mine to a limited extent, operating for a time with pack-trains.

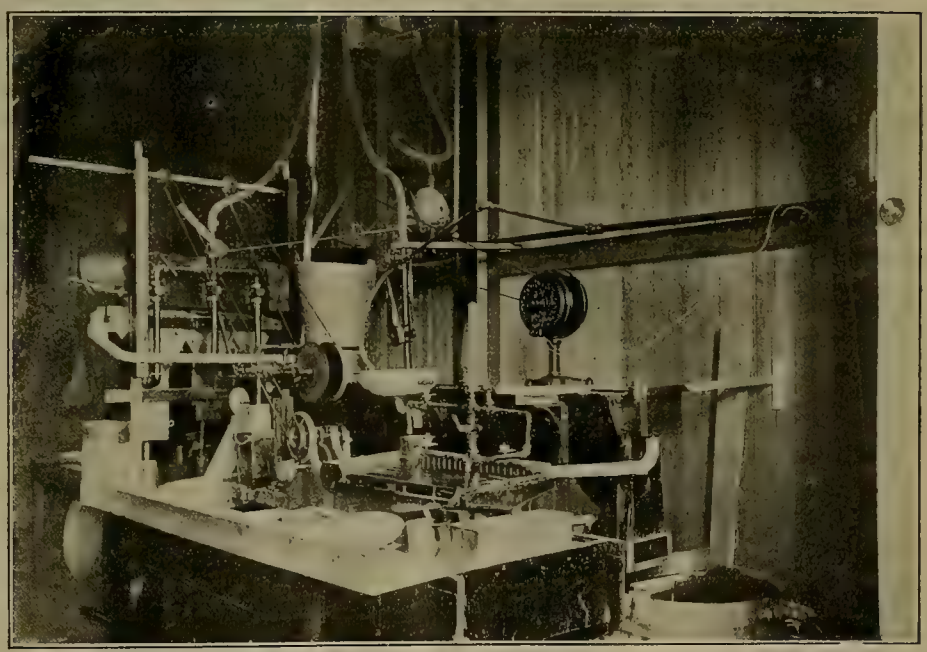
Shipping concentrate?

Yes, shipping concentrates to Durango, and bullion to the Denver mint. The venture was not successful, owing to limited capital, but I obtained much valuable experience in the rudiments of mining. I still own the property, and expect its value to be appreciated some day. My wife and I had many interesting experiences there, for we lived at the mill, which was just below timberline.

That would be 11,000 ft, would it not?

The mine was at something like 13,000 ft. and in a

MR. CALLOW AS AN IRRIGATOR IN COLORADO



THE ORIGINAL TESTING-PLANT WITH WHICH MR. CALLOW STARTED HIS BUSINESS

wild and snowy country, and the mill some 2000 ft. lower. After the shutting-down of this enterprise, I returned to Denver and soon afterward came to Utah for the purpose of re-designing the old Highland Boy cyanide mill into a concentrating plant. This put me in touch with Mr. Thomas Weir and Mr. Samuel Newhouse, both of them energetic and well-known mining operators in the West. I joined the staff of Mr. Newhouse and did some of the early experimental work on the ores of the Boston Consolidated, at Bingham, and of the Cactus mine at Milford. Later, I was designing engineer for the Annie Laurie Mining Co., operating in Sevier county, Utah, owned by P. L. Kimberly. This was a dry-crushing cyanide plant and followed Cripple Creek practice as laid down by Mr. Argall.

So you had some of the earliest experience in the treatment of porphyry ores?

The Bingham porphyries were just beginning to attract attention and I set up a little laboratory in the Dooly block to do jigging and panning tests on this ore. It was soon evident that the mineral was much too finely disseminated for a jigging operation, and the flow-sheet that I finally developed was one employing fine crushing and tables.

What kind of crushers and what kind of tables?

We proposed to use rolls followed by Chilean or Huntington mills, thence to hydraulic classifiers and Wilfley tables, thickening the slime in tanks and finally treating it on vanners, which were, at the time, the only machines adapted to the work. The recoveries, as I remember them, were around 75% and yielding a 30% concentrate from a 1.3% ore. I remember drawing up plans along these lines for the Boston Consolidated company, but they were never executed. At about this time I met Col. E. A. Wall at Bingham. He was then prospecting the ground now owned by the Utah Copper Company and was testing the ore in the old Rogers mill in Bingham canyon. I remember well his enthusiasm and faith in what was then facetiously known as 'Wall-rock'—a faith which in later years has been more than justified. Later on, Mr. Jackling repeated these tests in the same mill and eventually launched the Utah Copper Company and built the experimental plant at Copperton. About the same time, I was constructing the Yampa smelter for George Robinson, Jim Neill, and their associates. George Robinson has since 'gone West,' but Uncle Jim is still very much alive and a much esteemed friend.

What did you do at the Cactus?

I tested the ore, prepared the flow-sheet, and designed the mill, which was built by Mr. Bettles.

This mill was based on your own experimental work.

Yes, it was. The flow-sheet consisted of rolls, jigs, tables, and vanners.

When did you invent the Callow cone?

At about this time. I found the necessity for some settling device in mills employing fine crushing, and I had long appreciated the necessity for getting the slimy pulp to the proper density in order to do good work on the desliming machines. The first Callow tank was installed in the Cactus experimental mill, which I erected close to the mine for the purpose of testing the flow-sheet that had been planned in the laboratory.

Did you invent or design any other mechanical improvements?

About this time, I began to appreciate the great importance of sizing for table work. Out of this grew the invention known as the Callow screen, which is a traveling belt of screen-cloth on which pulp is spread, the oversize being retained on the traveling screen and the undersize passing through the meshes. These two devices—the screen and the tank—I turned over to the Galigher Machinery Co., as manufacturer and agent, and for some time, personally pushed these two inventions. They have had a wide application and served a useful purpose in their time. The Callow tank, of course, has since been replaced to a large extent by the Dorr thickener, and the screen, while still of considerable value in some positions in mills, has been set aside as a sizing scheme by the developments that have taken place in the roughing system of concentration.

How long did you remain with the Newhouse organization?

I must have been with Newhouse for two or three years, and then I set up in business for myself at Salt Lake City, in 1906, under the name of the General Engineering Company. We erected our own building and went into the regular ore-testing business. Shortly afterward, my brother Frank and Ernest Gayford became associated with me, we having all been school-boys together.

In connection with your testing operations, you must have gathered a great deal of technical information?

Yes, from the time I started with the Stearns-Roger company until now, some 14 or 15 years had elapsed, during all of which time I had been very active—to an extent, of course, impossible to detail here. I had long appreciated the importance of test-work preliminary to full-scale operations and had realized that the many failures to be seen throughout the country were due to the lack of testing, and that by the application of scientific knowledge and skill in the early stages, most of these mistakes could be avoided. It seemed to me, therefore, that a testing plant, and work of this kind, would offer a good opportunity for business, as well as the acquirement of useful information.

When did you become interested in flotation?

In the year 1909. Of course, I had become cognizant of the subject from reading the technical papers, and, afterward, from the introduction of the process at the Butte & Superior mill, in 1911.

But surely, you must have heard of the early attempts with the Elmore process, because Butters had a plant in Salt Lake City.

Yes. That reminds me; at about this time, I made the acquaintance of Stanley MacQuisten, and we did a large amount of test-work for him with his tube, which was a

most ingenious device, and quite effective on some kinds of feed. From the MacQuisten tubes, we were led to experiment with agitation flotation; we built machines and tried them in our laboratory, obtaining results that

THE GOLDEN HORN MILL

gave us a proper appreciation of the possibilities of this process as compared with gravity slime-treatment.

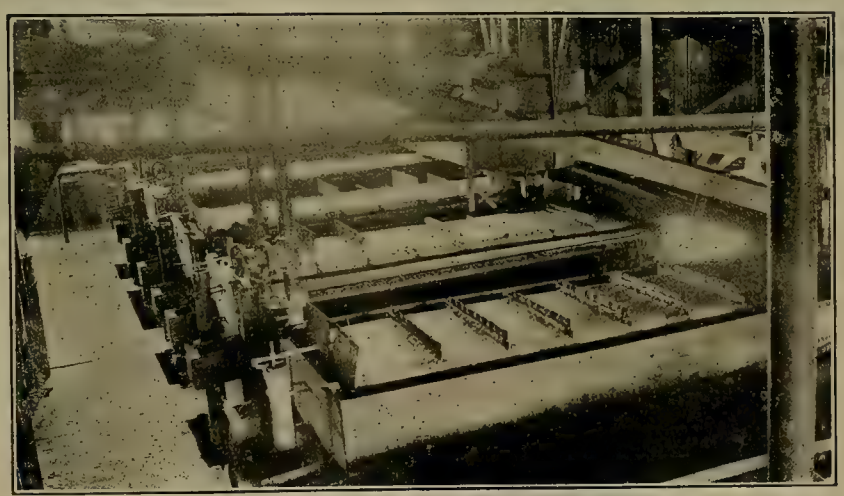
So that caused you to experiment further with the agitation-froth process as distinguished from the old methods of MacQuisten and Elmore?

Yes. I soon realized that the principal feature of the froth process was the introduction of the air, for to a man of mechanical instincts, it was self-evident that the propeller was a most clumsy method of accomplishing the purpose. A few years previous, I had occasion to design a filter employing a porous brick for the aeration of cyanide solutions, and this suggested the porous brick as a medium through which to introduce the air into the pulp for the purpose of making bubbles. Remembering that William H. Creden of the Davis-Daly Copper Co., of Butte, had one of these bricks in his office, I telegraphed to him for it, put it in the bottom of a square wooden box, and introduced a pulp that we had been endeavoring unsuccessfully to float in an agitation machine. The result was startling in its simplicity and complete success.

Was this air introduced under pressure?

Yes, it was, from a small compressor that we had in the basement, at about two pounds per square inch, as I recollect. We then got busy designing this type of machine. The first machines were circular with a porous brick in the bottom. We soon found that the sand tended to settle on the bottom of the brick and blind it. Then came slow-speed revolving stirrers to keep the sand in suspension. It was soon found that the circular machine was wrong in principle in that it was impossible in this type of machine to avoid a short-circuiting of the tailing to the tailing-discharge, and that the logical type of machine was an elongated box or launder. Out of this developed the machine which I eventually installed at the National Copper plant at Mullan, Idaho, in March, 1914.

At this time, you were unaware of the British patents obtained by T. J. Hoover in 1910 and also of the experimental work done by Robert S. Towne?



CALLOW CELLS IN THE NATIONAL MILL, AT MULLAN, IDAHO

Of course, I knew of Mr. Hoover through his book, and of some of his earlier patents; but at this time, I had never seen and knew nothing of any of his British

patents. Mr. Towne I had never heard of, and I knew nothing of the researches of either of them.

So you proceeded to design a flotation plant using this aeration device in the National mill?

Yes. Our experiments with this type of machine in the laboratory on the National ore had been so satisfactory and so conclusive that I decided to take the chances of introducing this type of machine into the National plant. It was a big chance to take, as the whole success of this mill depended upon flotation. Everything proved my judgment correct.

Please state the composition of the ore.

The ore was an extremely hard quartzite, impregnated with chalcopyrite, some chalcocite and bornite, together with iron pyrite. It required grinding to 60-mesh in order properly to liberate the copper mineral. My company designed and erected this plant; we started it in April 1914, and, barring the usual week or two for tuning up, it was a metallurgical success from the start. The operation of the flotation cells exceeded our most sanguine expectations. The plant caused more or less of a sensation and was visited by all the prominent mining and milling engineers in the West.

By this time, you had applied for patent?

Yes. I applied for my first patent in September 1914. This reminds me that I have left out part of my story. In 1911 and 1912, I was consulting mill-engineer for the Inspiration Copper Company and had done all the original test-work in a plant I had built for them at Miami. After the gravity-concentration tests were all completed, the question of flotation came up, and they asked me concerning its merits. The Minerals Separation company erected some of their machines in my old test-plant at Miami, and this eventually led to the adoption of flotation as the primary process for Inspiration ores and the abandonment of our old gravity flow-sheet.

Did you also experiment with flotation at the Inspiration?

Yes, later the Inspiration company built a larger and entirely new test-plant on their present mill-site and in this I set up a complete Callow equipment to go into competition with the M. S. machine.

Did you also experiment with flotation at the Inspiration company's first plant?

Yes, I put in an equipment at the Inspiration test-mill to go into competition with the M. S. machine. Here we fought for about a year with the M. S. and also with the Cole-Bergmann, the Towne, and the Flynn machines—the result of which was that today they are using machines of the type designed by me. I take pleasure in stating that the Inspiration company has recognized my invention and has paid for all the tonnage that they are now putting through their mill.

Meanwhile, what was the National mill doing?

The National mill did excellent work, the recovery running as high as 80%, with a 20-25% copper concentrate. Unfortunately, the mine was not able to furnish sufficient ore for the mill and it shut-down after about a nine months' campaign. Since then, it has, at various times, started up, and I believe is again running satisfactorily, using the original flotation plant in every essential respect as we put it in.

Mr. Callow, are you still using canvas as your porous medium for the bottoms of your flotation cells?

Yes, canvas is still the porous medium through which we introduce the air in pneumatic flotation, but owing to the increasing price of canvas and the difficulty of obtaining supplies, and some other weaknesses inherent to this material, there is a tendency to go back to my original porous brick, and some of the mining companies have done a good deal of experimenting with porous bricks made from portland cement and sand, with varying success. We, ourselves, have made some hundreds of experiments in the development of a suitable porous-brick medium, which will soon take definite shape, and which will have much more strength and greater porosity than any other medium now in use.

How do you regard the future for flotation?

I think the future offers tremendous opportunities, both in the way of improvement in the mechanics and also in the technique of the art. I am satisfied that pneumatic flotation will eventually cover the great bulk of the field. On some complex ores, it may still be necessary to use violent agitation as one of the tools with which to work, but for the majority of ores, the simplicity, efficiency, and low cost of operation will render pneumatic flotation pre-eminent.

Do you expect to see the use of the process extended to ores not now treated by flotation—for instance, will you not say something about the treatment of oxidized ores?

Flotation already covers nearly all classes of ores, not only of the base, but also of the precious, metals. For the treatment of oxidized ores, flotation may find a limited application, and further research may extend this field. At present the sulphide filming of oxidized ores by the use of a soluble sulphide seems only to be successful on the carbonates of lead and copper, the recoveries on the silicates and oxides being poor. There is an immense field for sulphide filming if we could once discover how to film the silicates and oxides, but at present this is not known.

In the course of your many experiments and tests, have you obtained any idea of the factor essential to floatability.

With two out-standing exceptions—coal and graphite—all the most easily floatable minerals are sulphides, or, if oxidized, must be coated with an artificial sulphide, which would indicate that sulphur is a necessary constituent, at least, of the surface of the mineral to be floated.

How about scheelite?

We have not been successful with scheelite, or any other unfilmed oxidized minerals, although graphite floats readily, and this exception to the generalization I

have just ventured to make lead one to suspect that the floatable properties of a mineral were not solely dependent upon their being sulphides, but upon their lustre. On the other hand, cinnabar, which floats readily, has this sulphur constituent but lacks a metallic lustre.

Native gold and silver are floatable, to a limited extent, but it is difficult to say how much of this is due to their entanglement with the accompanying sulphides and how much to their inherent flotative properties.

Native copper is being floated in the Lake district, when in a finely-divided condition, but even then, it is difficult to float. There is no doubt, however, that the sulphide minerals are more easily floated, which leaves us in a dilemma as to whether sulphur is a necessary constituent, or merely coincident to a lustrous surface.

Naturally, you must be pleased with the recent decision of the Ninth Circuit Court of Appeals in the Butte & Superior case?

I am, of course, because it confirms the stand that I have always taken in this matter.

By the way, you recognize the great number of possible flotation agents, and I presume that you have tried most of them yourself?

Yes. I have tried every likely flotation agent, and a great many unlikely ones, either in our laboratory in Salt Lake City or at our research department in the Mellon Institute at Pittsburgh. They would number many hundreds. From all those mentioned in the many patents and from others, my opinion is that it is only a matter of time when 'oil' (as we call it) may have to take a second place as a flotation agent. Our experiments and experience with alpha-naphthylamine and other allied synthetic compounds is sufficient to justify this statement. They have upset, in a great measure, many of our previous oil-flotation theories.

Of course, the successful use of plain sea-water for floating the kind of copper ore common along the coast of British Columbia and Alaska upsets all preconceived notions that oil was essential to flotation.

This is quite true, and opens up some interesting speculations. The use of salt is not new to us, as we have used it off and on for a long time. So far as our experiments go, it is restricted to the treatment of pyrrhotite ores and the selection of the copper from the iron minerals. The same, of course, can be done with oils or other mixtures, but that is beside your question.

Mr. Callow, does your family include any future mining engineers?

I have three daughters, and one son, who has strong mechanical instincts, and I hope that he will in time join the ranks of the profession, and improve on what I may have done.

THE NATIONAL MILL, AT MULLAN, IDAHO

AN ACID-PROOF ALLOY that is highly resistant consists of 47% copper and 5% tungsten. It is also mechanically strong; and it possesses great electric resistance. An alloy of 50.5% nickel, 43.65% copper, 3.9% tungsten, and 1.87% iron is recommended also.

The Importance of Gold Production

By Sir LIONEL PHILLIPS

*In considering the chief cause of higher working costs on the Witwatersrand goldfield we are confronted with a situation that appears anomalous in some respects. The War has had a very serious effect upon the gold-mining industry of the world. Western Australia has suffered even more grievously than we. Why have wages and stores risen? Largely because they are paid for in a paper currency that, owing to inflation, has depreciated. If there had been enough gold to pay for the balance of external trade in the precious metal, exchanges would have remained normal and the creation of paper money, to transfer the predominant part of internal trade from the ordinary channels into the hands of the Government, would not have caused the great depreciation that we have witnessed in its value. We are in a vicious circle. A rise in commodities involves a rise in wages and vice versa, and thus the snowball of national debt goes on growing from the double cause of expenditure and rising prices. Every thoughtful economist looks at the future with grave misgiving. Debts incurred upon commodities at a high cost must some day be paid for in commodities. The higher their price the less in quantity needed to square the account. On these premises, the greater the inflation and the higher the value of commodities, the easier the extinction of debt. Unhappily the reverse of this reasoning may have to be faced. A time may come when the supply of commodities will exceed the demand and depress prices. We live in a competitive world and shall hence have to meet our obligations in commodities at the cheapest rate at which they can be supplied from any part of the globe. For the extinction of external debt there is only one substitute for commodities—gold. And again, sufficient commodities for the re-payment of huge debts can only be produced, or for that matter absorbed, in the course of many years, and the deferment in the payment of debt during that period can only be secured, at fair rates, by credit based upon gold. We have all read a good deal of specious argument on the subject of the gold standard and its abolition, but the fact remains that, although reputation for national probity is of great worth and permits delay in settling debts, no amount of confidence in the integrity of a debtor and no amount of sophistry about 'liquid wealth' in the shape of raw materials and an industrious population will pay debts. Hard cash, goods, or services of a valuable character are the only considerations acceptable to the creditor. These are the reasons why the gold output has been, and still is, of such vital consequence. The British Empire produced last year £56,139,030 out of the total world output of £87,983,130, or 63.8%. The standard price for fine gold here is roughly 85s. per oz. Its varying value is not expressed in a rise or fall in the value of the metal, which fluctuates infinitesimally, but in the rise and fall in the price of commodities and in exchange rates between different centres. Rates of exchange have little to do with the wealth of a country; they mainly represent the state and tendency of trade-balances. The movement of a relatively small amount of gold has a surprisingly large effect upon rates of exchange.

It is not my intention to grapple with the abstruse subtleties of the currency question. The consideration of that problem was entrusted to a committee at the beginning of the present year, under the chairmanship of Lord Cunliffe—until recently Governor of the Bank of England—with a number of distinguished gentlemen, two of whom are connected with the Treasury, eight of whom are bankers, three members of great financial houses, and one a professor of political economy. It is a body whose conclusions will undoubtedly be treated with respect. The currency question, however, certainly deeply concerns the gold-producing countries of the Empire, and it is rather surprising, therefore, that no representation of their interests was given upon the committee. The interests of the gold-producer and those of the banker or merchant are not always identical. In a recent letter from Mr. Samuel Evans, the managing director of the Crown Mines, who has given a great deal of able thought to the question, this aspect is presented in the following terms:

"The business of bankers is to deal in money, money in all forms, and, consistent with the maintenance of confidence, the more money—not only gold, but also paper— there is to deal in, the more profit they can make for their shareholders. The annual reports of the leading English banks show that, on the whole, 1917 was one of the most prosperous years they have ever had, due largely, I take it, to the fact that, owing partly to the inflation of the currency by means of the printing press, they had more money to handle than in normal years."

I think my correspondent may not have given full weight to ruling rates of interest in his review of banking prosperity. It is certainly in the interest of the banks, in one sense, that there should be an ample supply of paper currency and of stocks and securities which bear interest, with limited obligations in regard to gold cover. But, apart from the fact that most bankers will take a broader view, there is a limit to the representation of wealth in such a form, because inflated currency means high prices, and high prices mean in turn less

*Part of a speech delivered at the annual meeting of the Central Mining & Investment Corporation, in London, on June 27, 1918.

safety for advances upon securities and materials. Copper, for instance, at a market value of £50 per ton is better security than copper at £100 per ton. The financial stability of the world is undoubtedly best protected by the backing of as much gold as possible against paper securities and emergencies. It is not necessary, however, for me to pursue this branch of the subject for the purpose of showing—as I think I shall be able to—that gold during the war period at least, has been of greater value than the consideration paid for it. I want to get a clear field to start with. Do not let us mix up the purely domestic question of cost of working, or whether certain low-grade mines should be subsidized or closed down. Those are matters for the exclusive consideration of the people of gold-producing countries. If gold was of such a value that it paid to buy it for more than the normal price, I could understand a special bonus per ounce being given to the Government concerned for distribution among those working material not sufficiently productive to cover the entire working cost. Or a Government faced with this problem might deem it in the interest of the State to subsidize needy mines for the purpose of giving employment to the people. Such considerations are purely of local concern.

The value of our gold in the world's markets is another matter and takes no cognisance of the yield or cost of working the mines. The subject is complexing and delicate. I desire to deal with it fairly and in no partial spirit. When war broke out an agreement was made with the Bank of England to purchase the output in South Africa at the standard rate, subject to certain charges. At the time the terms appeared, as I am sure they were intended to be, entirely fair to the producers. In the early days of the War the immense purchases of material from abroad and the diminishing export trade manifested themselves in adverse exchange-rates, and as the effect was brought to my notice by a representative of some of the gold-producing companies, I directed the attention of the Government to the matter. This was at the end of August 1915. I did not pursue the subject then for a variety of reasons, which it could serve no useful purpose to enter into now. Very shortly after that the Bank of England, at the instance of the British government, made certain modifications in the first agreement which involved higher charges to the mines, but stated "it was not desired to make profit or loss on realization." Without laying too much stress on the matter, I feel bound to note that the producers were not given much opportunity of expressing their views upon the subject. A definite offer was made which left no opening for negotiation. I confess, however, that no one could then foresee either the duration of the War or its effects upon the finances of the world. Everyone knows, moreover, and gratefully acknowledges, that but for the British Navy the gold-mining industry would have come to a standstill. Since the agreement was made, we have steadily watched the increasing losses to which the gold-mining industry has been subjected from a variety of causes, but we contend mainly on account of the adverse exchanges. In recent times I have again taken this matter up, and I believe it is now receiving serious consideration, as a result of which I trust that an expert inquiry may be instituted, so that the equities of the case may receive the consideration to which they are entitled.

With the solitary exception of gold, all commodities have risen, at least in the ratio of their increased cost of production. Fine gold (if we exclude the small amount now permitted to be used for trade purposes, which has risen to something like 115s. per oz.) has remained stationary at the standard price of 85s. per fine ounce. That the raw gold from South Africa is worth more than the price paid for it in paper currency is not a difficult matter to demonstrate in general terms. It is extremely difficult to assemble the data required to prove the amount of the increased value. That is the problem that awaits solution. If we assessed its value according to the rates of exchange it must be admitted that the Exchequer made a very profitable bargain. But the rates of exchange are not the true measure of its value, because it was used partly to regulate those rates, and without our gold the adverse exchanges would have been still higher. We must, however, not lose sight of the fact that our gold can only be disposed of in markets able to consume it on the one hand and give commodities or credits for it on the other. We could not, therefore, if we had had a free market during the War, have hoped always to ship our gold to the particular country among our Allies or Neutrals that at any moment needed it most. Surely here is a case for investigation and, if my contention be upheld, adjustment. Just as we may acknowledge without reservation that the bargain was made in the utmost good faith, so we may reasonably expect, being of opinion the British government has made a large direct or indirect profit out of the transaction, that they will cause an inquiry. Of one thing we may rest assured. The nation would not desire to profit at the expense of producers of any commodity in any part of the Empire. To support my view in broad terms only a simple illustration is required: if we could have paid for our commodities in our own gold, instead of depreciated paper, we should have obtained due compensation in value for part of the increase in our working costs. Theoretically, we could have distributed the commodities bought with our gold at its par value among our workmen (who would not then have needed higher wages to the same extent) and among our shareholders, who would have had higher dividends. Impoverishment or enrichment of the ore treated, taxation, supply and demand, allowances to men serving, etc., would, of course, have influenced the profits, but those factors do not affect the question under review.

Gold held in reserve earns no interest, and therefore is a charge, but it is like all other stock-in-trade, of which hundreds of millions must always be inert in every country, and it is the easiest form in which real wealth may be stored as security for negotiable paper. It is, in fact, an easy form of compressing into very limited

compass the actual representation of a given amount of accumulated material and fruits of industry. My distinguished friend, Mr. Hennen Jennings, in his admirable paper 'The Gold Industry and the Gold Standard,' considers gold coins as "storage-cells of human energy." Stock-taking in such a commodity offers no difficulty. When peace is restored and trade once more flows into its natural channels, it may be assumed that gradually rates of exchange will approximate to pre-war normal conditions, but there will be an intervening period, and perhaps a long one, before that happy stage can be reached. Meanwhile, the restoration of our position in this country would appear to require as much gold as we can possibly attract to our Mint. As far as gold producers are concerned they would, of course, have to take their chance if there is to be a free market for gold, and they might find themselves not unhappily placed under such conditions, but, if the control now reigning is to continue, especially in peace times, then the situation calls for authoritative review and a settlement, the fairness of which is unimpeachable. If the Government holds the view expressed in 'The Times' money article of the 10th instant: "It would, of course, not be possible to allow the mines to realize their gold in whatever market they pleased. That would mean that this country would lose control of the output, which it could not afford to do," it is imperative to discover not only how far it would be equitable to make good any losses suffered by the producers of gold during the War, but to think out a basis which would satisfy oversea producers and their governments in the disposal of their output, either for a given number of years or indefinitely in the London market. While it may be admitted, on the one hand, that no country can afford, except in a case of momentary emergency, to pay more than £1 in value for £1 in gold, the consideration given must be worth £1, and that has not been the case during the War, which is the chief reason for the cost of getting gold being higher than it was in pre-war days. Given full value is paid for the product, then I cannot imagine any system which would justify the subsidizing of gold mines whose yield does not exceed the cost of extraction. The stress in some countries might be so great after the War that they would actually be ready, in order to secure a certain amount of gold to enable them to revive external trade, to forfeit a certain amount of material and labor for this purpose, which is the real effect of a bounty. Such a course of action could not be regarded as sound, and would only be resorted to for the attaining of some specific and probably temporary object.

POTASH is recovered from alunite by crushing it, mixing with crushed coal, and roasting in a revolving furnace. This eliminates part of the contained sulphur by reducing the SO_4 and causing it to be evolved as SO_2. The residuum then consists of $K_2SO_4 + Al_2O_3$. The potassium sulphate is leached with water, leaving the insoluble alumina. The dissolved potash salt is recovered by evaporation of the liquor.

Engineer Officers' Training-School at Camp Humphries

The War Department authorizes the following statement from the Engineering Corps:

The Chief of Engineers, General William M. Black, announced today that the Engineer Officers' training-camp, scheduled to open about August 1, will be situated at Camp Humphreys, 17 miles south of Washington, on a plateau overlooking the Potomac river. Two thousand candidates for commissions as captains and first lieutenants will be trained under the same facilities provided for the 17,000 engineer replacement troops now there preparing for over-seas service. These facilities include the ordinary military arrangements, and in addition some 15 special schools to instruct men on such operations as mining, quarrying, gas and flame-defense, barbed-wire fortification, water-supply, and railroad communication.

The candidates for commission will become familiar with the work of all these schools and conclude their training with a course in sapper-work, in order that they may be fitted to command sapper-troops if necessary. Many of the candidates will come from civil life, a campaign being under way to interest men of technical training and experience.

Many applications for entrance to the training-camp have been received. To examine these candidates, General Black has designated a traveling board, which will visit several of the larger cities and determine the physical and mental fitness of the applicants. This board will be headed by Major E. H. Williams, who will advise the candidates as to the dates on which they should appear in the cities to be visited for examination. Candidates for first lieutenantcies should be between 32 and 36 years old, and those for captaincies between 36 and 42. Traveling expenses to the camp will be allowed successful candidates. Those accepted before August 1 will be sent to the existing Engineer Officers' training-camp at Camp Lee, Petersburg, Virginia.

VANADIUM and arsenic were found in the subterranean waters of Bella Villa, Córdoba, Argentine, in sections of the city where the inhabitants obtain their water from wells. Water from three wells was examined by A. A. Bado; 50 litres being evaporated in each case. Wells No. 1, 2, and 3, respectively, contained 0.3, 1.12, and 0.32 parts per million of As; well No. 2 showed 4.8 parts per million of V_2O_5; well No. 1 a trace of iodine. Two samples of water from the river Tercero, flowing through the city, contained 0.04 and 0.01 parts per million of arsenic as As; tests for vanadium were negative. Bado considers the arsenic to be combined as sodium arsenate and the vanadium as sodium vanadate or meta-vanadate. Arsenic was determined by twice evaporating the residue from 25.1 of water to dryness with HNO_3, removing the SiO_2 and evaporating the filtrate with H_2SO_4 until appearance of SO_3 fume, and then using the Marsh apparatus.

CASTING SWING UPON DERRICK FOR WELDING

Oxy-Acetylene Welding of a Roll-Frame

By O. J. ZOOK

PRE-HEATED CASTING BEING WELDED

The use of oxy-acetylene welding for the repair of broken mining machinery is coming into more general use, many interesting and difficult jobs being undertaken. The Butte & Superior Mining Co. recently completed a welding job notable for its size, being one of the largest ever undertaken in the United States.

During the summer of 1916 the frame of one of the

WELDER AT WORK

54 by 20-in. Garfield rolls was broken between the sliding and stationary bearings, the break extending from the outer side of the frame to the inner side. The break was caused by the carelessness of an employee in letting an 8-lb. hammer pass through the rolls, which had new oversize shells, thus leaving little clearance between shell and frame, so that the hammer forced the movable roll back against the end of the frame, causing the break.

At that time a repair was effected by chipping notches

in each end of the frame, and shrinking on a 3-in. square bar with reinforced hooks at either end. This answered the purpose satisfactorily for a time, but the continuous vibration finally caused it to work loose. It was then decided to weld the break, at the same time renewing the inner side of the frame where the ore had worn through the casting. Measurements were taken, and patches for each side of the hopper were cast. These patches measured 4 ft. 4 in. by 3 ft. 6¾ in. The worn parts were then chipped out, the patches being fitted and clamped into place. The roll-frame was moved outside the building. A wooden derrick with several I-beams across the top was erected, and then equipped with crawls and chain-blocks. This was necessary in order to turn the casting over, enabling the welder to reach the reinforcing ribs underneath.

The casting was raised six inches above the ground and set on fire-brick. A dry wall of fire-brick was built around it to act as a furnace for heating. A charcoal fire was built in and around the casting, it being evenly heated to prevent warping during the welding operation. After the casting became a dull red the welding was started, the break being welded first, then the ribs on the outer side of the patches. After completing this, the casting was set on edge, as can be seen in the accompanying illustrations, the welds being made along the ends of the patch on the lower side and the reinforcing ribs underneath. After this was completed the casting was turned over and the opposite patch welded. The heat produced by the oxy-acetylene torch for welding is 6000° Fahrenheit.

The size of the job can be realized when it is noted that the casting along the cracks is from 1¼ to 3 in. thick, the total length of welds being 28 ft. The casting weighed 40,000 lb. It required 84 hours to chip the casting and fit the patches, and 72 hours for heating and welding. The work was done under my personal supervision. The rolls have been in operation again for the past three weeks and no flaws have developed. Apparently the frame is as good as new.

The company has its own acetylene-generating plant, and is well equipped to do this class of work.

Concentrating a Tin-Wolfram-Lead Ore

*The Butler tin mine is situated seven miles from Torrington, New South Wales, in fairly rough granite country. The lode is worked by an adit-level 920 ft. long, and also by a main shaft; the deepest point in the workings is 315 ft. from the surface. Ore has been opened above No. 1 and 2 levels, and at No. 3 intermediate level, at a depth of 300 ft. A considerable amount of development had been done before the present company took over the mine and started to erect the plant for treatment of the tin ore.

When milling started in July 1916, it was found that the lead in the ore made the concentrate unsaleable. The average assay of the concentrate was 53% Sn, 12% WO_3, and 5% Pb. In order to overcome the trouble it was decided to erect a Minerals Separation flotation unit for recovery of the lead, and a magnetic separator to take out the wolfram.

The primary treatment section includes ten 1250-lb. stamps. The crushed ore, after passing through an automatic sampler, goes to a three-compartment classifier. The first compartment feeds No. 1 and 2 Wilfley tables, the second, No. 3, and the third, No. 4. The overflow from the classifier goes to two Callow tanks, from which the thickened product is fed to No. 5, 6, and 7 Wilfleys. The overflow goes to the settling-box, thence to the vanners. The headings from No. 1 and 2 tables go to hydraulic cleaners, and the headings from No. 3 and 4 to a settling-box. The seconds from No. 1 and 2, also from No. 3 and 4, are re-treated on No. 5 and 8 Wilfleys. The headings from No. 5, 6, 7, and 8 tables go to a settler on a buddle, the seconds to vanner, and the tailing to the flume.

The tailing from the flume passes into a V-box with a 1½-in. opening three inches from the bottom for the escape of coarse sand, while the overflow is distributed over bag-strakes. The fine material from the strakes is further dressed on a Triumph vanner. Below the strakes the overflow joins the coarse sand discharged from the V-box, before passing through the tailing-sampler and into the three-compartment dewatering-box, thence to a slime-settling tank. The overflow from this is returned by pump to the battery-feed tank.

The recovery given by the wet-concentration plant—Wilfley tables, Frue and Triumph vanners—is 80.0% Sn, 67.7% WO_3, and 66.0% Pb. Owing to the large amount of slime, the result is considered excellent.

Secondary treatment: After being dressed the tin-wolfram-lead concentrate is sent to an M. S. flotation unit. The leady concentrate is floated off into settling-boxes for subsequent re-treatment, while the tin-wolfram residue is dried and treated by magnetic separator. A Berdan pan is used for re-grinding any portion of the leady concentrate considered too coarse for flotation. The flotation unit gives a recovery of 98% of the lead. The magnetic separator, which is of the 'motor' type, gives a marketable product when working on a fairly coarse tin-wolfram concentrate; but is not comparable with the Wetherill type in dealing with the fine, owing the amount of re-treatment required. C. L. Smith is manager of this interesting property.

*Abstract from 'Chem. Eng. & Min. Rev.,' Melbourne, Australia, June 5.

BRACKEN is considered a likely source of potash. The ash of bracken contains 40 to 50% of soluble K_2O. The weed grows abundantly on some Australian soils, yielding as much as 400 lb. of ash per acre. The ash is bulky and gray in color, distinctly alkaline, and slightly caustic. The alkalinity is due to carbonates and to some extent to free CaO and MgO. The potassium is combined principally as sulphate and chloride, and to a less extent as the carbonate.

CRIPPLE CREEK, COLORADO

Dividends for Half-Year.—Rich Ore From Leases.

Dividends distributed during the first half of 1918 totaled $1,487,000. The so-called close corporations and leasing, sampling, and milling companies are not included in this.

A rich shipment was made last week from the American Eagles mine, on the summit of Bull hill, when between 35 and 40 tons of 40-oz. gold ore was sent under guard from the Basket and Luce lease on the 15th level. This lease was tied-up by litigation for more than four years. The royalty under the agreement permitting these lessees to resume operations will be paid in to the first National Bank of Colorado Springs, to be held in escrow, pending settlement of the litigation between Stratton's Cripple Creek Gold Mining & Development Co.—the Stratton estate—and the Findley Mines Co., involving apex rights.

The Excelsior M. L. & E. Co. having made connection with the Golden Cycle mine workings from the 500-ft. level of its main Llewellyn shaft, is dispatching a car of ore daily. It will assay from $25 to $50 per ton.

ST. LOUIS, MISSOURI

Proceedings of the American Zinc Institute.

The American Zinc Institute met at the Stadtler hotel, St. Louis, on July 29 and 30. The address of welcome was by the president of the St. Louis Chamber of Commerce. F. C. Wallower, manager of the Golden Rod Mining Co. at Joplin replied. The chairman, Victor Rakowsky, outlined plans and the purpose of the meeting. An address, 'Benefits to be derived from close co-operation of zinc smelting and mining interests in helping win the War', was given by W. R. Ingalls. C. E. Siebenthal, of the U. S. Geological Survey, spoke on the 'World's Zinc Resources and Their Political Control.'

On the second day an address on 'New Uses of Zinc' was given by A. P. Cobb, vice-president of the New Jersey Zinc Co. 'The Value of Experimental Work in Developing New Uses of Zinc and Zinc Products,' was discussed by John Johnson of the Research Council of National Defense at Washington. J. L. Bruce, of the Butte & Superior Mining Co., covered 'Zinc Mining and Production in Western States.' Other addresses were: 'Zinc Mining and Production in South-Eastern States,' by J. N. Houser, vice-president of the American Zinc, Lead & Smelting Co.; 'Sheet Zinc Industry in United States and Benefits of Co-operation Between Mining and Smelting Interests,' by E. H. Wolfe, president of the Illinois Zinc Co., Peoria, Illinois; 'Zinc Mining and Production in Missouri-Kansas-Oklahoma and Arkansas,' by Otto Ruhl of Joplin; 'Zinc Mining and Production in Wisconsin,' by W. N. Smith, manager of the Vinegar Hill Zinc Company.

There were 200 men at the meeting, representing every branch of the zinc industry in the United States. Nearly every smelting company sent a representative. The Joplin district (Missouri, Oklahoma, and Kansas), Wisconsin, and Colorado districts had a large number attending. The keynote of the meeting was closer co-operation between all branches of the industry in order to ameliorate prevailing conditions. The organization committee elected, who will draft the final plans to be adopted, are W. R. Ingalls, A. P. Cobb, and Edward Mosbaugh of New York; J. N. Houser, Willam Lanyon, and A. B. McMillan of St. Louis; W. B. Shackleford, P. B. Butler, C. T. Orr, and W. H. Eardley of Joplin; J. R. Cole of Tulsa, Oklahoma; J. C. Haywood of Yellville, Arkansas; D. D. Dunkin of Webb City, Missouri; Fred H. Hale Jr. of Goodsprings, Nevada; G. L. Coleman of Miami, Oklahoma; J. H. Billingsley of Galena, Illinois; J. L. Bruce of Butte, Montana; Julius Hegeler of Danville, Illinois; G. E. Nicholson of Kusa, Oklahoma; O. S. Picher of Chicago; and E. H. Wolfe of Peru, Illinois.

MAP OF THE UNITED STATES SHOWING LOCATION OF IMPORTANT ZINC-PRODUCING DISTRICTS, ZINC SMELTERS, ZINC-OXIDE PLANTS, AND ELECTROLYTIC-ZINC PLANTS. After U. S. G. S.

TORONTO, ONTARIO

Cobalt, Porcupine, and Fort Matachewan Notes.

Dividends declared by Cobalt companies during the first six months of 1918 amounted to $2,368,527, compared with $3,115,379 during the corresponding period of last year, a decrease of 24%. Only eight companies have declared dividends this year, against thirteen in the first half of 1917.

La Rose Consolidated has decided to discontinue dividends and conserve its cash for carrying on development in the Violet property, where a new vein has been cut on the 400-ft. level. A high-grade vein, 4 to 6 in. wide, has also been found on the 70-ft. level of La Rose.

At the Gifford a cobalt-calcite vein has been cut on the 350-ft. level.

The Peterson Lake mill has been started, and will treat tailing from the Seneca dump, by re-grinding and flotation.

Porcupine.—The Dome Mines company has let a contract for driving a long cross-cut on the 1200-ft. level toward the Dome Extension boundary to determine the value of an extensive orebody indicated at that depth by diamond-drilling.

Operations on the Vipond-North Thompson have been suspended; but the exploration of the Thompson-Krist property adjoining through the Vipond N. T. workings is being carried on with satisfactory results.

The McIntyre is preparing to develop the Newray at considerable depth, on which it holds a two-year option, as the best results there have been between 700 and 1000 ft. A system of selective mining will be adopted.

Fort Matachewan.—The option held by the Mining Corporation of Canada on the Davidson claims has expired, and negotiations for its purchase have been broken off.

SUTTER CREEK, CALIFORNIA

Progress at the Old Eureka.—Lincoln, Keystone, and Bunker Hill Mines.

The shaft at the Old Eureka mine has reached a depth of 2400 ft., which is 240 ft. below the lowest point reached by the former owners. The contract held by the present shaftmen will carry the work 60 ft. farther, and when the shaft has attained a depth of 2460 ft., new contracts will be let. The old mine has been opened by a three-compartment shaft from surface to 1600 ft., incline depth, and the new owners' first work after unwatering the mine was the enlarging of the shaft from 1600 to 2160 ft., so that the main skips could be used from the surface to the bottom. This was a long and tedious job, and shortage of labor, difficulty in securing machinery, and other abnormal conditions served to delay progress, but good headway is now being made. The company is to sink to 3160 ft. before doing much exploration on the orebodies exposed in the old workings, or following the veins cut in sinking. The shaft has passed through some good-looking rock within the past few weeks, and there is said to be a large shoot of pay-ore practically blocked out between the 1200 and 1600-ft. levels. Improved methods of milling since former operation of the Old Eureka should yield a good profit from ore considered waste by those who allowed the mine to fill with water 30 years ago; the concentrate was not saved at all, and amalgamation was crude. The new owners have ample funds to properly equip the mine, and so far all installed is modern. A ranch to the east of the shaft, added by the new company to the original holdings, is well situated for use as a mill-site, while other ground has been purchased for use as a tailing impounding area.

D. V. Ramazzotti, who is connected with the Knight company's foundry here, has purchased the old machinery belonging to the Lincoln Mining Co., in the mills and around the hoisting plants of the Wildman, Mahoney, and Lincoln mines, and has men removing everything of value. These plants have been idle for a number of years, and the workings will be equipped with up-to-date machinery when the new owners are ready to re-open the combined properties. In the meantime, the iron and steel salvaged in dismantling the old works will help relieve current needs. The Wildman portion of the Lincoln company's holdings underlies Sutter Creek and adjoins the Old Eureka property. As many of the same people are interested financially in the two mines, there is a probability that a combination may later be affected. An immense body of low-grade ore was developed on the 1400-ft. level of the Wildman shaft just before financial difficulties compelled the former owners to suspend operations, and both the Lincoln and Mahoney mines not only yielded well in early days but contain ore that can be profitably handled by modern methods.

The Keystone Mines Co. made a profit of $1500 in June, which is encouraging. Considerable development is in progress in addition to the mining of low-grade ore, but costs have been reduced to a minimum, and prospects are fair for opening better ore at an early date. Forty stamps are dropping steadily. Carlton R. Downs of Sutter Creek is manager of this property, which has been in continuous operation since the time of its discovery in the early 'fifties.

Twenty stamps are crushing ore on day shift at the Bunker Hill mine, north of Amador City. Shortage of labor for development has seriously hampered operations for months past. A 10c. assessment has been levied for additional exploration and the possible sinking of the shaft to another level. C. E. Bunker is superintendent.

VICTOR, COLORADO

Program of the A. I. M. E. Meeting in Colorado.

The American Institute of Mining Engineers will meet at Denver and Colorado Springs from September 2 to 7.

The meeting opens at the Brown Palace hotel at Denver on the first day. There will be a technical session in the morning, followed by a visit to the ferro-manganese plant, and a trip to Look-Out mountain. Next day, at noon, members meet at the Broadmoore hotel at Colorado Springs. Besides a technical session, trips will be made to the Golden Cycle mill at Colorado City, and the Portland, Cresson, and Independence mines at Cripple Creek, also the Portland mill and a trip around the district. At Pueblo will be visited the plant of the Colorado Fuel & Iron Co., the smelter of the American Smelting & Refining Co., and the zinc plant of the same company. A run will be made to the top of Pikes Peak. Ladies will be suitably entertained and the closing banquet will be held Friday night. Spencer Penrose is chairman of the local committee, A. E. Carlton, chairman of the finance committee, and Charles McNeill, president of the State section.

VICTORIA, BRITISH COLUMBIA

Smelting Charges and Bounty on Zinc.

The mine operators of the Kootenay district are petitioning the Dominion government to appoint a royal commission to investigate the reduction charges of the Consolidated Mining & Smelting Co. at Trail. It is represented that the committee of the Associated Boards of Trade of British Columbia, which was authorized by the Dominion authorities to proceed with the inquiry and granted $3000 toward its expenses, has not large enough powers to enable it to make its work thorough. It is maintained that $10,000 at least is needed, and that there should be power vested by the Government in the Committee to enable it to take sworn testimony. Meanwhile, O. R. Whitaker, of Colorado, who this year prepared a report of similar character in Colorado, has been retained by the Dominion government to assist

ALASKA

Treadwell.—Ore is being hoisted from a depth of 2800 ft. in the Ready Bullion mine of the Alaska United. This is the deepest mining in the Territory.

ARIZONA

Jerome.—There is nothing new in the labor situation here. It is evident that the decision of the Federal mediater, Hywell Davies, will be accepted when announced.

A new bonus-system has been announced by George Kingdon, general manager of the U. V. X. Employees remaining continuously in the service of the company for one year will receive $100 bonus at the end of such year's service, and $10 for each additional year's service until a total of $250 is reached, after which the latter amount will obtain as long as such service remains continuous. The rule takes effect July 1, 1918, and the first year's bonus will be paid August 1, 1919. Thirty days lay-off with permission will be allowed each year. However, in cases of sickness or accident, such lost time will not be deducted from the time alloted for lay-off.

The Green Monster company has suspended work in its Gorge tunnel to concentrate operations in sinking the Dorothy May shaft, which is now in schist at 765 feet.

The Gadsden shaft is down 1142 ft. in quartz-porphyry, quartz, jasper, and schist. Some of the formation is mineralized.

United Verde Copper paid $1.50 per share on July 18. This makes $18.50 for the current year, $1 more than the whole of 1917.

Phoenix.—The State Tax Commission's valuation of mining companies for the year totals $421,936,854, a gain of $82,716,226. All of the large properties are assessed at a higher rate.

CALIFORNIA

Bishop.—Little has been heard of the Consolidated Wilshire Mining Co., operating near here, but on July 23 it was reported that ore had been found at a depth of 76 ft. An assessment of 1c. per share is due on August 19. Part of this is to be used in enlarging the mill.

Cima.—There is said to be a good deal of interest in tungsten possibilities near this place in San Bernardino county. The Peru Mining Co. holds 7 claims, on which sampling shows ore to carry 3.6 to 5.5% tungstic oxide.

Kennett.—The Shasta National Copper Co. has made a final payment of $40,000 on a large group of copper claims west of the Mammoth. Extensive diamond-drilling will be undertaken at once, it is announced. The company is composed largely of Pittsburgh capitalists.

Redding.—The hull of the dredge being built across the river by the American Gold Dredging Co. was floated on July 20. It will be a month or six weeks before machinery will be in place and the dredge ready for operation.

Peardmont.—Frank F. Peard, vice-president of the United Tungsten-Copper Mines, is to supervise the building of the company's first 25-ton mill at its tungsten mine in San Bernardino county. The company owns 300 acres in the Morongo district that has been developed during the past 18 months. Ore-reserves warrant the new mill. A recent shipment of 600 lb. of scheelite from sluice-boxes was very satisfactory. The U. S. Government assayer at Salt Lake City returned 69.7% on concentrate and 77.9% in the scheelite crystals. Ricketts & Co. of New York gave 71.24% on the concentrate, and Smith, Emery & Co. of Los Angeles gave 71.47% for the 600 pounds.

COLORADO

According to Charles W. Henderson, of the U. S. Geological Survey, the production for the six months of 1918 shows a considerable decrease in gold and an appreciable decrease in silver. Copper has never been an important mineral in Colorado, and in 1918 so far it shows an appreciable decrease as compared with 1916 and 1917. The output of lead has remained practically stationary during 1918. The market for the low-grade zinc ores of Colorado is not encouraging, and the production has already fallen off considerably. There are no really high-grade zinc ores in Colorado comparable to those of the Miami, Oklahoma, field. Gold production from Cripple Creek for the first six months of 1918, compared with the same period in 1917, shows a decrease of $800,000; which, if continued, means for the year a decrease of $1,600,000 to $2,000,000. [A Denver paper states that the decline at Cripple Creek for the first half of 1918 is only $58,317.—Editor.] Leadville already shows a decrease in the output of gold, silver, copper, and zinc, but an appreciable increase in the output of lead. The output of manganese-iron ores from Leadville for use at steel plants has been steady. The re-opening of the Ute and Ulay mines at Lake City, Hinsdale county, and the development work at Creede promise to add to the lead output of Colorado. San Juan county has not quite maintained the output it made in 1917, but the San Miguel county (Telluride) mills have produced at a greater rate. Decreased supplies of ore have caused the closing of the sampling-works at Black Hawk, Gilpin county, and at Georgetown, Clear Creek county, both old establishments. The sampling-works at Idaho Springs has continued its operations. The number of active mines in Boulder county has become small. The dredges in Summit county have so far not yielded their usual output, but production during the first three months of the year is generally low at Breckenridge; the dredging begins to be good in June. The sampling-works at Breckenridge has been closed. The Derry Ranch dredge, near Malta, Lake county, resumed operations in May. Mines at Bonanza, Saguache county, have continued operation with promise of a considerably increased production when the tramway from Bonanza to the mill now building at Shirley is complete.

Aspen.—The organizing and taking over of many claims and fractions virtually gives the Park Tunnel, Mining & Milling Co. control of the Tourtellet Park mining section of Aspen mountain. This company is composed mainly of experienced Aspen and Leadville men. The adit to open the orebodies has been started on the Tubal Cain at the head of Keno gulch, and will be driven 3000 ft. south-east to a point directly beneath the workings of the Last Dollar, at a depth of 800 ft. From the mouth of the adit a tramway will be built to connect with the railway near the New-

man tunnel. Robert Shaw and Frank M. Yates of Aspen are president and secretary, respectively.

Boulder.—The increased freight rates, smelter charges, taxes, wages, and cost of supplies is felt heavily here, especially by lessees. Ore carried by the Denver, Boulder & Western line previously had the following rates:

Value per ton	Rate per ton
Under $20	$1.80
$20 to $30	3.75
$30 " $40	4.50
$50 " $100	5.75
$100 and over	7.00

The recent 25% increase over all old rates ordered by the Government increased the schedule to:

Value per ton	Rate per ton
Under $20	$2.25
$20 to $30	4.70
$30 " $40	5.60
$50 " $100	7.20
$100 and over	8.80

Freight rates on the D. B. & W. may be lowered.

Smelting charges jumped from the old rate of $4.50 to $6, and recently to $6.50 per ton.

Denver.—At Utah Junction, near here, ferro-chrome is being made from chrome mines in California and Oregon, according to a Denver paper.

Eldora.—The old Springdale silver district is being reworked, ore now being shipped.

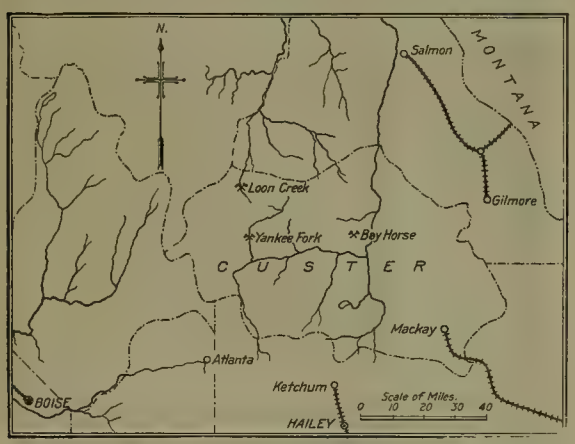
Leadville.—A contract has been let to extend the Anderson tunnel 750 ft. in Prospect mountain. This will make a total length of 2300 ft. C. H. Weaver is manager.

In the Matchless mine on Fryer hill an iron-silver vein, assaying 5 to 10 oz. per ton, has been opened at a depth of 92 feet.

Lessees at the Gray Eagle on Carbonate hill have found a new deposit of manganese on the 600-ft. level.

IDAHO

Ore deposits in the north-western part of Custer county are described by J. B. Umpleby in Bulletin 539 of the U. S. Geological Survey. The area studied, comprising the



PART OF IDAHO, SHOWING DISTRICTS IN CUSTER COUNTY DESCRIBED IN REPORT

Loon Creek, Yankee Fork, and Bay Horse districts, includes several promising deposits and a few mines where a considerable tonnage has been blocked out for a number of years, awaiting more advantageous transportation facilities. It is believed, however, that with high prices for metals much of this ore might be mined at a good profit. The deposits include gold placers and lodes carrying gold-silver, gold-copper, and lead-silver ores. In most of the deposits the ore is of excellent grade. North-western Custer county is certain to produce large amounts of silver, lead, copper, and gold in the future, if only from deposits now developed. The deposits of the Bay Horse district are by no means exhausted, and in some a considerable tonnage is actually blocked out. Many others are inadequately developed, and much of the intermediate territory is comparatively unprospected. In the Yankee Fork district little ore has been opened, and any considerable future production from the shoots now recognized is problematical, but in a heavily-timbered area where such bonanza deposits have been found there is ever the probability of new discoveries. One noteworthy discovery is known to have been made since the report was written. The Loon Creek district contains gold placers that will probably be worked in the near future. In addition to these there are gold-copper veins, one of which has been explored to a depth of 1000 ft., and throughout this vein the ore has ranged in value from $25 to $90 per ton with no evidence of impoverishment with depth. The area of dolomitic limestone near the head of Deer Creek is also thought to be a promising field in which to prospect for lead-silver deposits. It is highly probable that in a rough country like north-western Custer county new deposits will be found when mining again becomes active. Under normal metal prices such activity could scarcely be expected to precede the advent of a railroad, for the larger properties are held by companies which for many years have shown no inclination to rob the known deposits. At present, however, there is believed to be abundant justification for prospecting and reasonable exploitation.

Adair.—The Richmond M. M. & R. Co., according to its president, J. E. Codd, has cut 10 to 14 ft. of 20.3% copper ore on the 150-ft. level. The shoot has been followed for 100 ft., the width being from 4 to 8 ft. carrying 5 to 6% copper, excepting for the new section. Fifteen carloads of ore have been shipped since June 15.

Burke.—The Hecla company is mining 1200 tons daily. Of this, 750 tons goes to the mill at Gem, 200 tons to the Federal mill at Wallace, 50 tons to the smelter, and the remainder is waste. A station is being cut on the 2000-ft. level. Labor is 20% short.

Kellogg.—On July 17 the Caledonia company paid its regular monthly dividend of 3c. per share, equal to $78,150.

At the Bunker Hill & Sullivan smelter two furnaces are in blast. More men are wanted at the mines.

Mullan.—The Interstate-Callahan expected to resume milling early in August. The plant has been closed since June 1 for improvements, which are considered will give a 15% higher recovery.

MICHIGAN

Houghton.—On August 15 the Champion company pays $6.40 per share, making $12.80 for the current year.

Following an air-blast in the Quincy mine last week, a fire started, but was quickly put out. Fire also started in No. 3 and 4 shafts of the Ahmeek. These were sealed in order to smother the outbreak.

St. Mary's Mineral Land Co. pays $2 per share on August 15. This is the second of like amount this year.

Copper output of the Mohawk in June was 783,771 lb., against 1,042,182 lb. a year ago. Wolverine produced 336,455 lb., a drop of 119,731 lb. compared with June of 1917.

Calumet & Hecla reports as follows for June and the year to date:

Mine	June, lb.	6 months, lb.
Ahmeek	2,301,867	13,976,220
Allouez	619,217	3,972,854
Calumet & Hecla	5,076,774	36,092,278
Centennial	236,100	1,332,885
Isle Royale	1,461,165	7,325,096
La Salle	138,249	1,013,644
Osceola	1,505,758	8,300,655
Superior	164,332	996,531
White Pine	205,750	1,372,690

MISSOURI

Joplin.—Production of the region last week was 6795 tons of blende, 720 tons of calamine, and 1194 tons of lead. These averaged $52, $35, and $100 per ton, respectively. The total value was $531,918, of which Missiouri contributed $119,068.

The Connecticut Zinc Corporation, at Joplin, known here as the Oronogo Circle Co., is building the largest concentration plant in the district near Oronogo. F. L. Wilkins is general superintendent.

Seneca.—The Oklamo Mining Co., which is drilling on the Seneca fault in Ottawa county, Oklahoma, near Joplin, has cut rich lead ore at a depth of 35 to 50 ft. The hole will be continued to 300 ft., the deepest in the field. A 200-ton mill is proposed.

MONTANA

Butte.—Anaconda is shipping 700 tons of manganese daily. The status of the Butte, Anaconda & Pacific Railroad is not decided. It may remain in control of its owner, the Anaconda company, and not pass to the Government. Most of its business is carrying ore, etc., for the company.

The Butte-Ramsdell company, leasing the Lizzie claim from Davis-Daly, is mining some good ore from an 8-ft. vein.

A Federal employment office was opened at Butte last week. A large crowd registered. Labor agitators are said to fear that the regulations may be more strict than those of the Anaconda company.

Labor is restless here, in spite of the recent 50c. raise in wages. The Metal Mine Workers' Union on July 26 posted a notice saying: "The Metal Mine Workers' Union wishes to warn the membership against the misleading inference that a strike is to be called for tomorrow noon. Stay at your work until we find that there is no other course left to settle our grievances. Hold your places until a general call is issued." On July 26, C. F. Kelley, vice-president of the Anaconda company, stated publicly at Butte that the I. W. W. would never be consulted regarding the labor situation. Organized labor would be treated squarely. The latest demands are unreasonable.

Great Falls.—Anaconda's new copper rod and wire mill here is working well, and has plenty of orders to keep it busy. The first shipment of rods went to Montreal, Canada. The order is for 250 tons.

NEVADA

Ely.—Machinists on the Northern Nevada railroad—Ely to Cobre—struck for $7.22 per 8-hour shift on July 15. The line is tied-up; no ore is moving from Ely to McGill. This demand has been refused by the manager. Machinists at the mines and works will not join the others.

Goldfield.—The Atlanta company is being re-organized as the Reorganized Atlanta Mines Co. Work is under way on a vein at 1850 feet.

On its 500-ft. level the Red Hill Florence mine is showing the best ore. A carload has been shipped. A winze is being sunk on this shoot.

The Silver Pick shaft is 1200 ft. deep, where lateral work is to be started. G. F. Dyer is manager.

Goodsprings.—Shipments from this district in June were 33 cars of zinc, lead, and copper ore, 2 cars of zinc ore, 1 car of lead ore, and 6 cars of zinc slime.

Pioche.—Prince Consolidated has purchased for $60,000 cash a ½ interest in the Davidson claim, making the company the sole owner. The Prince property now consists of 18 full and contiguous claims. The new shaft is down 450 ft., being sunk from surface, along with stations, etc., by the Walter Fitch, Jr., Inc., in 60 days. M. C. Godbe is general manager.

Tonopah.—At a depth of 1150 ft. the Great Western company, operating in the western area of this district, has opened an orebody 12 ft. wide. The ore is not of commercial grade, but this development proves the ore-zone in the district to be 1500 ft. beyond where it had been worked.

The Extension is sinking to 1850 ft. Water, up to 300 g.p.m., has hindered work somewhat. On the 1500-ft. level are three pumps, and another is to be put in at 1680 feet.

The Tonopah Divide has cut 22 ft. of ore on the 370-ft. level, about equal in value to the level above. Rich ore is showing on the foot-wall.

OKLAHOMA

Picher.—Production of the district last week was 5218 tons of blende and 1013 tons of lead valued at $395,630.

Strand.—The Red Granite Copper & Water Co. has been organized to develop pyrite deposits near here. W. E. Hudson is president. The Graselli Chemical Co. is to buy the ore at $7 per ton. The ore is near the surface. Strand is not far from Joplin, Missouri.

OREGON

The U. S. Geological Survey, through C. G. Yale of the San Francisco office, has issued advance figures of mine production during 1917. The returns were (those for 1916 being in parentheses): producers, 76 (108); ore treated, 142,438 tons (159,071); placer gold, $727,366 ($872,517); gold from deep mines, $764,432 ($1,029,662); silver, 125,656 oz. (231,342); copper 2,474,487 lb. (3,581,886); lead, ... lb. (28,000); and total value, $2,270,874 ($2,937,487). Baker county's gold mines and placers, and copper, accounted for $1,689,601; and Josephine county $370,981.

SOUTH DAKOTA

Production of gold in the Black Hills district for the first six months of 1918 shows a small decrease when compared with that for the same period in 1917, according to Charles W. Henderson, of the U. S. Geological Survey.

UTAH

Cisco.—The Grand River Placer Co. has been organized to enlarge operations on gravel claims 11 miles from this place in Grand county. O. W. Kumrow is president. Present plant capacity is 35 cu. yd. daily, to be increased to 200 yd. Gold content is said to be high. A Mitchell amalgamator is in use, but tables are to be put in to save black sand, magnetic iron, and tin.

Marysvale.—Swift & Co. of Chicago are the latest to enter the alunite field, taking an option on the Bradburn claims. E. G. Briggs is representative for the firm.

The Florence mill will be ready to extract potash by September 1. At present, alunite from this mine is sent to the Chamberlain mill.

The Deer Trail company is shipping two or three cars of lead-silver-gold ore per week to Salt Lake smelters.

The I-X-L is producing rich lead-silver ore.

Watson.—The Ute Oil Co. has issued a well-illustrated prospectus. The capital is $1,000,000, shares $1 par, the company being incorporated in Arizona. C. M. Curry is field manager; I. Grettum, shale-plant superintendent; and G. W. Wallace with W. E. Griffiths, consulting engineers. A report on the shale lands was made by David T. Day of Washington, D. C. Core-drilling to a depth of 300 ft. was suggested. The estimated cost at the crude oil stage was $1.02 per ton of shale. The process of retorting coal and shale was also discussed by Mr. Day. G. W. Wallace, consulting engineer, reports that an hour's distillation of shale yielded 51.5 gal. of crude oil per ton, also 3.6 gal. of gasoline from gases. The cost of producing oil from one ton of shale is given as $1.90 per ton.

WASHINGTON

Advance figures of mine production during 1917 have been issued by the U. S. Geological Survey, compiled by

C. N. Gerry. There were 136 producers, an increase of 23, yielding a total value of $2,289,285, a gain of $240,935 compared with 1916. This does not include coal or magnesite. The 172,119 tons of ore treated gave 23,816 oz. of gold, 282,320 oz. of silver, 2,199,518 lb. of copper, 9,789,687 lb. of lead, and 1,195,567 lb. of zinc. Ferry county (Republic) contributed nearly 70% of the gold. Copper fell off 445,000 lb., this coming from Stevens county (Chewelah). Lead gained 4,400,000 lb., coming from near Northport.

Kiesling.—The Spokane Tin & Tungsten Co. has been organized with a capital of $1,500,000, to develop a property in this district. F. C. Bailey and others of Spokane were the incorporators.

CANADA

British Columbia

Anyox.—Employees of the Granby Consolidated are demanding a raise of $1 per day, of which the company offers 25 cents. Laborers get $4.75 at present, higher than anywhere in the Province. About 2000 men are affected by the strike. Living conditions are comfortable, as the company rents good houses to its employees.

Ontario

Cobalt.—On August 1 the Coniagas paid a 2½% dividend, equal to $100,000. This makes $300,000 for 1918, and $9,040,000 to date.

Gowganda.—This silver district is reported to be generally active. The Miller Lake O'Brien mine is producing regularly; the Walsh mine has an 8-in. vein on the 100-ft. level; the Castle is being sunk to 300 ft.; work is to be started on the Bonsall claims; and negotiations are under way to develop other properties.

Kirkland Lake.—The Wright-Hargreaves mine is now developed sufficiently for a mill, so one of 150-ton capacity is to be erected at once.

Porcupine.—The West Dome Consolidated Co.'s report for 1917 states that 4438 ft. of work was done. The vein averages $8 per ton. Arrangements are being made to have the ore treated. Cash on hand on April 30, 1918, was $38,000.

Barite is now being shipped at the rate of 30 tons daily from the Premier-Langmuir mine, near here. The mill makes a high-grade product, worth $38 per ton. Charles Dalby is manager.

MEXICO

Mexico City.—A U. S. Consular Report dated July 13 states that the press on that day published a circular of the Department of Industry, Commerce, and Labor, permitting foreigners to present denouncement of mining claims without prior presentation of citizenship certificate called for in paragraph 1 of Article 27 of the Constitution, but this certificate must be presented before completion of denouncement proceedings. Claims previously denounced by foreigners will be accepted and foreigners will be allowed until August 31 next to present certificates referred to.

Guerrero

Acapulco.—A U. S. Consular Report, dated April 1, states that mining failed in development last year and the reputed rich mines of the district remained untouched. The development of this industry will wait on railroad and highway construction.

Sonora

Cananea.—Greene-Cananea, since resuming late last year, has had six months of peaceful operations, production steadily increasing. The output to June 30 was 23,780,000 lb. of copper and 626,370 oz. of silver. The company's financial condition is strong.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

A. J. Sale was in San Francisco from Nevada.

Samuel H. Dolbear has returned from New York.

G. L. Sheldon, of Ely, Nevada, is in Beaverhead county, Montana.

Walter G. Perkins has returned from New York to San Francisco.

Falcon Joslin has returned from Washington to Fairbanks, Alaska.

Homer L. Carr was in San Francisco and has gone to Soulsbyville, California.

Milton A. Allen, of the University of Arizona, was here from Tucson for a few days.

Philip N. Moore, accompanied by **W. N. Cummings,** sailed from Seattle on July 23 for Alaska.

Fred B. Ely has received appointment as First Lieutenant in the Aviation Section of the Army.

C. E. Addams has resigned as general manager for the Arizona Hercules Copper Co., at Ray, Arizona.

Harry H. Webb returned from an inspection of the La Grange mine in time to attend the Bohemian jinks.

McClelland Henderson, of Johannesburg, South Africa, passed through San Francisco on his way to Oregon.

E. A. Sperry, professor of metallurgy in the University of Peiyang, at Tientsin, sailed for Shanghai on August 3.

E. A. Julian has succeeded J. W. Hutchinson, now in the Army, as manager of the Goldfield Consolidated Mines Company.

Harry H. Webb Jr., of the U. S. Aviation Service, lost four fingers of his right hand in battle and is now in a French hospital.

W. Spencer Hutchinson, of Boston, is in Peru, making an examination of the properties of the American Vanadium Company.

R. W. Brock, Major, formerly director of the Geological Survey of Canada, has been appointed geological expert in Palestine for the British government.

Richard Hamilton, general manager of the Great Boulder mine, has been re-elected president of the Chamber of Mines of Western Australia for the twentieth time.

Robert Chartran, recently engineer with the Lena Goldfields company in Siberia, has arrived in San Francisco, after a most difficult journey over the trans-Siberian railway.

B. Magnus has been commissioned Captain in the Engineer Reserve Corps, and is now on active duty. He requests that all communications for him be sent care of Henry M. Toch, 320 Fifth avenue, New York.

Austin F. Rogers, associate professor of mineralogy in Stanford University, accompanied by **Charles W. Coyle,** of Oakland, was at Placerville, California, on July 23 making an inquiry into the mineral resources of El Dorado county.

William D. Gordon, for the past seven years manager for the Mine & Smelter Supply Co. at El Paso, has been elected president of Camphuis, Rives & Gordon, Inc., and has opened American headquarters for the company at 81 New street, New York.

J. W. Crowdus has been commissioned as First Lieutenant in the Engineer Reserve Corps. He reported for duty at Camp Lee, Virginia, August 3. Mr. Crowdus has just completed a 300-ton concentrator of his own design for the 85 Mining Co. at Lordsburg, New Mexico.

THE METAL MARKET

METAL PRICES

San Francisco, July 30

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30— 9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

ORE PRICES

July 30

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—$8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 54%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28
Tungsten, 60% WO_3, California, per unit	$20—$24

EASTERN METAL MARKET

(By wire from New York)

July 30.—Copper is unchanged, but strong. Lead is scarce and firm. Spelter is dull and weaker.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange.

Date	New York, cents	London, pence
July 24	99.62	48.81
" 25	99.62	48.81
" 26	99.62	48.81
" 27	99.62	48.81
" 28 Sunday		
" 29	99.62	48.81
" 30	99.62	48.81

Average week ending	
June 18	99.50
" 25	99.50
July 2	99.50
" 9	99.62
" 16	99.62
" 23	99.62
" 30	99.62

Monthly averages

	1916	1917	1918
Jan.	56.76	75.14	88.72
Feb.	56.74	77.54	85.79
Mch.	57.89	74.13	88.11
Apr.	64.37	72.51	95.35
May	74.27	74.61	99.50
June	65.04	76.44	99.50
July	63.06	78.92	99.62
Aug.	66.07	85.40	....
Sept.	68.51	100.73	....
Oct.	67.86	87.38	....
Nov.	71.60	85.97	....
Dec.	75.70	85.97	....

Silver exports in the fiscal year ended June 30, 1918, totaled $139,000,000, an increase of $61,000,000 over the previous year. Imports amounted to $70,000,000, double those of a year ago.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. Quotations in cents per pound are as under:

Date	
July 24	26.00
" 25	26.00
" 26	26.00
" 27	26.00
" 28 Sunday	
" 29	26.00
" 30	26.00

Average week ending	
June 18	23.50
" 25	23.50
July 2	23.50
" 9	26.00
" 16	26.00
" 23	26.00
" 30	26.00

Monthly averages

	1916	1917	1918
Jan.	24.30	29.53	23.50
Feb.	26.62	34.57	23.50
Mch.	26.65	36.00	23.50
Apr.	28.02	33.16	23.50
May	29.02	31.69	23.50
June	27.47	32.57	23.50
July	25.66	29.67	26.00
Aug.	27.03	27.42	....
Sept.	28.28	25.11	....
Oct.	28.50	23.50	....
Nov.	31.95	23.50	....
Dec.	32.89	23.50	....

Owing to some uncertainty regarding the application of the restriction imposed by the War Trade Board upon the importation of copper ore, the Board has altered the original ruling to read that hereafter no licenses will be issued for the importation of copper concentrates containing less than 60% of copper, except for shipments from Cuba, Canada, and Mexico. All outstanding licenses for the importation of copper concentrates containing less than 60% have been revoked as to shipments from abroad after July 20, except for shipments from the three countries above specified, from which copper ore may be imported. This restriction is not to be construed as affecting the importation from any non-enemy country of copper matte or blister copper, or copper concentrates containing 60% or more of copper. The purpose of the new ruling, as of the former one, is to bring about the ocean transportation of copper in a concentrated form rather than as the bulkier ore.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date	
July 24	8.05
" 25	8.05
" 26	8.05
" 27	8.05
" 28 Sunday	
" 29	8.05
" 30	8.05

Average week ending	
June 18	7.01
" 25	7.82
July 2	7.90
" 9	7.99
" 16	8.05
" 23	8.05
" 30	8.05

Monthly averages

	1916	1917	1918
Jan.	5.95	7.64	6.85
Feb.	6.23	9.10	7.07
Mch.	7.26	10.07	7.26
Apr.	7.70	9.38	6.99
May	7.38	10.29	6.88
June	6.88	11.74	7.58
July	6.40	10.93	....
Aug.	6.28	10.75	....
Sept.	6.86	9.07	....
Oct.	7.02	6.97	....
Nov.	7.07	6.38	....
Dec.	7.55	6.49	....

Lead ore at Joplin last week was stronger at $100 per ton, an advance of $2.50, basis of 80% product.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
July 24	8.62
" 25	8.50
" 26	8.50
" 27	8.37
" 28 Sunday	
" 29	8.37
" 30	8.37

Average week ending	
June 18	7.70
" 25	8.18
July 2	8.78
" 9	8.85
" 16	8.78
" 23	8.68
" 30	8.45

Monthly averages

	1916	1917	1918
Jan.	18.21	9.75	7.87
Feb.	19.99	10.45	7.97
Mch.	18.40	10.78	7.87
Apr.	18.62	10.20	7.04
May	16.01	9.41	7.29
June	12.85	9.63	7.92
July	9.90	8.98	....
Aug.	9.03	8.58	....
Sept.	9.18	8.33	....
Oct.	9.92	8.32	....
Nov.	11.81	7.76	....
Dec.	11.26	7.84	....

Owing to a weaker spelter market last week zinc ore at Joplin fell off $2.50 to $5 per ton, the base price for 60% product being $50 and $52.50 per ton.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds:

Date	
July 2	120.00
" 9	120.00
" 16	120.00
" 23	120.00
" 30	120.00

Monthly averages

	1916	1917	1918
Jan.	222.00	81.00	128.06
Feb.	295.00	126.25	118.00
Mch.	219.00	113.75	112.00
Apr.	141.60	114.50	115.00
May	90.00	104.00	110.00
June	74.70	85.50	112.00
July	81.20	102.00	120.00
Aug.	74.50	115.00	....
Sept.	75.00	112.00	....
Oct.	78.20	102.00	....
Nov.	79.50	102.50	....
Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918
Jan.	41.76	44.10	85.13
Feb.	42.60	51.47	85.00
Mch.	50.50	54.27	85.00
Apr.	51.49	55.63	88.53
May	49.10	63.21	100.01
June	42.07	61.93	91.00
July	38.37	62.60	....
Aug.	38.88	62.53	....
Sept.	36.66	61.54	....
Oct.	41.10	62.24	....
Nov.	44.12	74.18	....
Dec.	42.55	85.00	....

ORES (New York)

Ferro-manganese: The market is quiet but strong at $250 per ton, delivered, for 70% alloy, plus $4 per unit above this standard. Imports for June, so far reported, were 5739 gross tons, the largest for any month this year.

Molybdenum: The market is easier with sales at $1 per lb. of MoS_2 in 90% concentrate.

Tungsten: The supply of high-grade ore is not equal to the demand, according to one dealer. Prices range from $18 to $20 for low-grade up to $24.50 per unit for 60% concentrate, and higher. There is no change in ferro-tungsten.

Eastern Metal Market

New York, July 24.

The news feature of the week, affecting all the markets, is the announcement of the virtual taking over or confiscation by the Custodian of Alien Property, A. Mitchel Palmer, for the Government, of L. Vogelstein & Co., Beer, Sondheimer & Co., the American Metal Co., and some lesser companies. These are some of the largest if not the largest producers of zinc, copper, and lead in the country. It means the Americanization of these companies, perhaps for all time.

The markets in general are quiet but mostly firm, with prices all stationary.

An advance in copper is predicted after August 15.

Tin is quiet and still scarce.

Lead is harder to buy than ever before, but quotations are held in check.

Zinc is inactive and slightly easier, but firm.

Antimony is fairly active and steady.

Steel producers have been made to understand, during the last week, more impressively than ever what demands are to be made on the industry in the last half of this year and the still greater ones in 1919. Next year the shipbuilding program is to be increased beyond anything yet believed, and railroad purchases will far exceed those for 1918. Even shell-steel must be furnished at a 5,000,000-ton rate. The War Industries Board has put the country's war and essential needs of finished steel at 20,000,000 tons for the last half of the year or 3,500,000 tons more than the expected output.

COPPER

A further advance in the Government maximum price is confidently discussed, and is even expected by some as a result of the next meeting in Washington on August 7 when a settlement of the price to become effective after August 15 is made. It is claimed that the sudden advance of 2½c. per lb. to 26c., made on July 2, does not cover the increased costs, and that 1½c. per lb. is absolutely necessary. This may have been foreseen at the meeting on July 2 so that instead of making a 4c. advance for August 15, part of it was authorized at once. This has resulted in so much confusion, especially following as it did an official announcement that no changes would be made before August 15, that all sales now are at the price ruling at the time of delivery. The fixed jobbing price of 5% above the wholesale maximum price is now $1 per ton higher, or 27.35c., instead of 27.30c. per lb. This is because the refiners are allowed an increase of this amount to recompense them for putting the metal in ingot form. Copper exports are considerably behind those of a year ago at this time. For the first half they are estimated at 186,370 gross tons, against 274,763 tons in the first half of 1917, or a decrease this year of about 32%. The June exports were 31,791 tons, exclusive of those to Canada, or about 10,000 tons less than those for June 1917. It is stated that the estimated output of refined copper for the first half of this year shows a net decrease of 50,000,000 lb. from that of the same period of 1917.

TIN

The market continues extremely quiet with practically no business being done. The only transactions reported have been a few in Banca and Chinese tin afloat. A sale is noted at 94c., New York, ex-steamer to arrive. Offerings of future shipment from the East, or from England, are almost entirely absent. This is due to new developments in the last few days, which are regarded as not only interesting but of decided importance. Announcement is officially made in England that the Federated Malay government has instituted a new ruling that sellers cannot ship tin except under license from that government and that such sales must be made on the basis of the Singapore and Penang quotations, plus expenses to London and New York and a reasonable profit. This is regarded by some as a ban on shipments to a certain extent. It amounts at least to price-fixing, and will ultimately affect the price of Banca and Chinese tin in this country. The effect and import of the new ruling is not clearly understood as yet, either here or in England, but it is regarded as far reaching. That this is so is evident from the fact that the lack of offerings from London is acute because sellers are apparently feeling their way. The quotation for spot tin in New York continues nominal at 94c. per lb., with none available in quantity. Isolated lots have sold up to 98 to 99c. per lb. Arrivals at Pacific ports continue large. To July 20 inclusive they have been 4280 tons, with those at Atlantic ports at 600 tons to July 17. The advance in the London market continues with spot Straits £10 per ton higher than a week ago, or £365 10s. per ton yesterday.

LEAD

A large wholesale dealer in lead said today that in his experience the metal was never more scarce. It is almost impossible to secure it for any reasonably early delivery. Most large producers have sold their output and some have oversold. The quotation is held by agreement at 7.75c., St. Louis, or 8.05c., New York, but there have been a few instances of sales of small lots above this level. A little spot metal went at 8.20c., New York, a few days ago and some dealers have sold one or two carloads at 8.75c., New York, to consumers greatly in need of the material.

ZINC

The report of the zinc output for the second quarter, published in the papers last week, has been of considerable interest. It reveals to what extent production has declined. The domestic output for the second quarter was 127,000 tons, or 9000 tons less than that for the first quarter this year, and 60,000 tons less than that for the second quarter of 1917. It is the lowest output for any quarter in the last three years, the next lowest having been 121,624 tons in the second quarter of 1915. The report also shows that producers having 196,000 retorts had only 111,000 or 57% in operation on July 1, or a decrease of 13,000 retorts from those operating April 1, 1918. Stocks of zinc also have declined. They were 46,000 tons July 1, or 18,400 tons less than those on hand April 1. This is a decrease of about 1400 tons per week. It would be natural to expect such a report to affect the market for an advance or at least to bring out inquiry. On the contrary, there is very little doing and, if anything, the market is easier. Sales were so large a few weeks ago that producers are comfortable and consumers not at all anxious. As a result little has happened to test the market. The quotation is regarded as partly nominal at 8.37½c., St. Louis, or 8.62½c., New York, for early delivery, with no one quoting for last quarter. There have been sales of small amounts at this level, also some at 8.50 to 8.60c., St. Louis. The market is not at all active but is considered temporarily reactionary but strong fundamentally.

ANTIMONY

In 5-ton lots or less, 13.25c. per lb. is asked for antimony, New York, duty paid, but in larger lots the quotation is about 13.12½c. The market is moderately active.

Company Reports

UNITED STATES SMELTING, REFINING & MINING CO.

Properties: mines and works in Arizona, California, Colorado, Utah, and Mexico.

Operating Officials: of U. S. S., R. & M. Co.: G. W. Heintz, general manager of Western operations; C. E. Allen, manager of mines; O. J. Egleston, chief engineer; L. D. Anderson, manager Midvale smelter; J. F. Barnard, superintendent Bingham mines; A. P. Mayberry, superintendent Centennial-Eureka mine; G. W. Metcalfe, manager Mammoth plant; R. E. Hanley, superintendent Mammoth mine; J. H. Kervin, superintendent Mammoth smelter; D. R. Muir, manager Gold Road and Needles properties; A. R. Campbell, manager zinc smelter; D. D. Muir Jr., manager zinc mines; A. P. Anderson, consulting mining engineer;. C. F. Moore, consulting engineer; and G. W. Cushing, traffic manager. Of U. S. S., R. & M. Ex. Co.: Sidney J. Jennings, in charge of exploration and mining investment; C. W. Van Law, general manager of exploration in Mexico and Colorado; G. W. Heintz, general manager of Western exploration; and E. N. Funston, engineer. Of Richmond-Eureka Mining Co. and Niagara Mining Co.: G. W. Heintz, general manager. Of Compania de Real del Monte y Pachuca: Salvador M. Cancino, president, D. S. Calland, director. Of U. S. Metals Refining Co.: F. Y. Robertson, general manager; R. W. Deacon, superintendent copper refinery, Chrome, N. J.; and William Thum, superintendent lead refinery, East Chicago, Indiana. Of U. S. Fuel Co.: R. M. Magraw, general superintendent. Of Sunnyside Mining & Milling Co.: J. W. Steele, superintendent. Of U. S. Stores Co.: J. H. Horlick, manager.

Financial Statement: the profit from all companies for 1917 was $4,197,815. This, added to the undistributed surplus from 1916, made $17,155,270 available. Of this, $692,500 was applied to taxes, etc., and $3,457,800 to dividends, leaving a surplus for 1918 of $17,155,270. Current assets total $17,493,387, and liabilities $8,788,044, leaving an excess of assets of $8,705,343. Capital expenditures and investments in 1917 totaled $6,462,199.

Dividends: preferred shares received 7%, or $1,702,225; and common shares $5 each, or $1,755,575.

Production: the Centennial-Eureka, Mammoth, Ritz, Tennessee, Bingham, and Mexican mines produced 1,129,678 tons of ore. Metals extracted, including custom ore, were

Copper, pounds	29,043,242
Gold, ounces	109,612
Lead, pounds	107,519,570
Silver, ounces	13,000,187
Zinc, pounds	53,590,446

Coal mined amounted to 908,638 tons.

General: in Utah, reserves were materially increased at the Bingham Mines property. Orebodies persist with undiminished strength to the Niagara tunnel. In the Centennial-Eureka ore extraction was carried on mostly near old stopes. Results at the Bullion Beck and Champion were only fair. The smelter at Midvale operated to capacity.

In Oklahoma, owing to the zinc market, all reduction was stopped save at the Checotah smelter. The Ritz mine and mill gave good results. On the Naylor tract in Kansas, drilling justified erection of a mill.

In California, in the Mammoth mine proper and Section 29, no large deposits were opened. The most important work was extending the Friday Lowden tunnel, including branches, to 7500 ft., and completion of Sutro 29 tunnel, 2500 ft. long. High-grade ore was opened from the Friday tunnel, also from the Sutro. The mine produced 164,540 tons of ore. The Stowell mine, 7 miles from the Mammoth, was equipped with an aerial tram. Ore sent to Kennett—18,497 tons—practically exhausted the reserve. Further exploration is under way. The Keystone claims give promise of being producers. The Anderson and Spread Eagle claims were not worked on account of prevailing conditions. The smelter reduced 345,990 tons of mixed ores, a large quantity coming from the Balaklala company. The electrolytic zinc plant worked satisfactorily.

In Arizona, only exploration was done at the Gold Road mine, with fair results. The lease on the Tennessee mine was surrendered as the remaining ore was unprofitable. The Needles concentrator was also closed.

In Colorado, the Sunnyside lead-zinc mine was taken under control, and a mill is being erected. The Leadville unit did not develop any profitable ore in the lower limestone, nor in the upper horizon. Work has been stopped altogether.

In Mexico, transportation and supplies were difficult to secure for Real del Monte. Trains were run on company account to the United States border. By mid-year full capacity was reached, and for 6 months the two mills treated 54,600 tons monthly, 10% above rated capacity. Both plants are being increased by 9000 tons each per month. A third mill may be erected to treat ore from the new vein, which is developing well.

In Alaska, a little work continues at the Ebner mine.

UTAH CONSOLIDATED MINING CO.

Property: 43 claims in the Bingham district, Uath.

Operating Official: Fred Cowans, manager.

Financial Statement: revenue from metals produced amounted to $3,395,109. Miscellaneous income in 1917 made a total of $3,496,806. Mining, smelting, and general charges were $2,684,612, leaving a profit of $812,194. Balance to credit at January 1, 1917, was $1,867,842; and carried forward to 1918, $1,541,165.

Dividends: totaled $1,050,000, equal to $3.50 per share.

Development: New work from 600 to 1300 ft. depth covered 29,206 ft. Generally, results were satisfactory, although it required 13% more exploration to maintain reserves at the previous estimate. Ore developed amounts to 141,000 tons of copper ore, averaging 1.76% copper, 0.65 oz. silver, and 0.05 oz. gold; and 31,000 tons of lead ore assaying 14.90% lead, 0.61% copper, 4.96 oz. silver, and 0.06 oz. gold.

Production: shipments to the International smelter at International, Utah, consisted of 226,536 tons of copper ore and 58,247 tons of lead ore. These yielded 7,968,165 lb. copper, 13,014,841 lb. lead, 408,560 oz. silver, and 13,530 oz. gold. Copper-ore production was limited by coal shortage at the smelter.

ROSE DEEP, LTD.

Property: 365 claims (1½ acres each) on the Rand, Transvaal.

Operating Officials: A. J. Walton, manager; consulting engineer; E. E. Clifford (H. Stuart Martin, acting).

Financial Statement: during 1917 the revenue from gold was £837,992 ($4,020,000), and expenditure £579,079 ($2,780,000). Government taxes totaled £29,989 ($143,000). The balance of £111,027 ($533,000) at end of 1916 was increased to £130,690 ($624,000) at end of 1917.

Dividends: two of 12½ and 17½% amounted to £210,000 ($1,008,000), making £3,391,875 ($16,300,000) to date.

Development: new work amounted to 7190 ft., 70% of which was in pay-ore, and exposed 532,110 tons. Reserves are estimated at 3,219,700 tons, averaging $5.40 per ton. By means of sand-filling a number of pillars can be mined.

Production: after 10.2% of waste assaying 39.4c. per ton was sorted out, the 300 stamps, 7 tube-mills, and cyanide works treated 689,859 tons of $6.19 ore. The actual extraction was 94.4%, yielding 200,811 oz. of gold.

Costs: all departments totaled 16s. 11d. ($4.06) per ton, a decrease of 8 cents.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

JORDAN SPREADERS

Over thirty years ago, Oswald F. Jordan saw the possibilities of a machine for spreading and leveling materials and for saving time, labor, and money by dispensing with slow expensive 'gang labor', which is uncertain and undependable. This resulted in the invention of the 'Jordan spreader'. Since that time the Jordan spreader has been

A SPREADER WORKING AT AN IRON MINE

adopted by nearly all of the railways of the United States and Canada, together with numerous installations in connection with mines, smelters, steel plants, and various classes of contracting work. Many of the original spreaders are still in operation, and have saved their owners large sums of money by eliminating gang labor. Many instances of Jordan installations have been reported where, by its use, its original cost was saved in less than a week.

The Jordan spreader moves, levels, and spreads clay, rock, slag, ore, debris, coal, coke, or other materials at a cost of 0.5 cent per cubic yard which is, by comparison, the lowest cost attained by any mechanical device. In open-cut mine operations, in the handling of smelter slags, in ore and coal-storage problems, in large-scale mine operations, in railway construction and maintenance, in disposing of dump-material and mill-tailing, the Jordan has proved itself a labor-saver that is second to none. Where more than eight men are employed on this class of work the Jordan soon pays for itself. Its construction is of steel throughout, with every detail so perfected as to make it last indefinitely with little or no up-keep charge. It is driven by one man, being easily controlled by a hand lever which operates the valves on the pneumatic cylinders. The Jordan spreads material 21 ft. from the centre of the track, and can be adjusted to spread and remove material to a depth of 21 inches. The spreader is 35 ft. long, 13 ft. high, and weighs 72,000 lb. It is equipped with Westinghouse air-brakes and standard hand-brakes. The spreader performs the function of a ballast-plow, flanger, scraper, bank-builder, spreader, and snow-plow, and is equipped for building high banks, ditching, and making shoulders to any standard. All operations are under the control of one man and uses an ordinary locomotive to supply the power. The illustration shows a Jordan spreader in operation at the plant of the Oliver Iron Mining Co. Here, as at the Utah Copper Co., the New Cornelia, the Calumet & Arizona, and other mining and smelting companies, the Jordan has been rendering a variety of services in the moving and spreading of material, dump building, track-work, and the like. As to the cost of operation, one Jordan spreader, working at a speed of only 1.36 miles per hour, can spread 75,000 cu. yd. of material in 10 hours. The cost of doing this work is as follows:

One locomotive and crew	$42.00
One operator	5.00
Oil, waste, etc.	2.50
Total	$49.50

To do the work by gang labor, figuring that one man can spread 30 cu. yd. per 10 hr., and putting his wage at $2.50, it would require the services of 2500 men at a cost of $6250. These figures are on a conservative basis, as the spreader has generally operated at a rate of from 6 to 8 miles per hour, and on all classes of material under the severest conditions. The Jordan spreader is manufactured by the **O. F. Jordan Co.**, at Chicago and Kennedy Ave., East Chicago, Indiana. Complete information as to the operation and use of Jordan spreaders on all classes of work will be submitted on request, together with estimates.

A large number of the architects, engineers, and contractors of San Francisco, on the invitation of **The Paraffine Companies, Inc.**, witnessed the application of Pabcoat—the stone veneer—by the air-spray method. The coating was applied to the interior of a new building recently erected for the Enterprise Electric Co. The purpose was to show that the owners were saving, on a conservative estimate, 30% in the cost of painting the building. One application of 'Pabcoat' by the air-spray method made a finished job equal to two coats applied by hand and at a great saving in time. The adaptability of 'Pabcoat' to practically any surface and its well-known fire-retarding qualities, caused a great deal of favorable comment.

The Allis-Chalmers Manufacturing Co. calls attention to its bulletin No. 4028, describing a pulverizer constructed on a new principle. It is termed a 'pulverator', being designed for the reduction of material from 3 in. to pass a 20-mesh screen. It is intended mainly for relatively soft material, such as cement clinker, limestone, coal, shale, feldspar, phosphate rock, gypsum, bauxite, and slag. A machine crushing 15 tons per hour requires 40 horsepower.

Mining and Scientific Press

Edited by T. A. RICKARD

Volume 117
Number 6

SAN FRANCISCO, AUGUST 10, 1918

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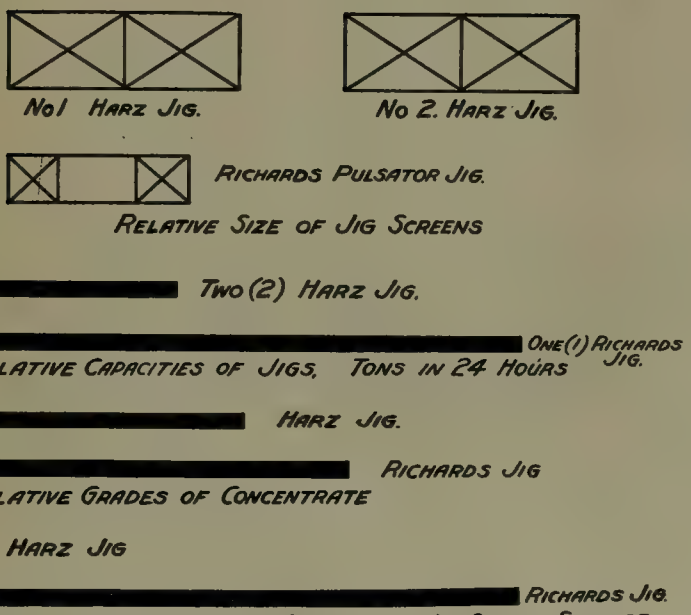
JIGS: A Comparison Graphically Shown


No1 Harz Jig.
No 2. Harz Jig.
Richards Pulsator Jig.
Relative Size of Jig Screens
Two (2) Harz Jig.
One (1) Richards Jig.
Relative Capacities of Jigs, Tons in 24 Hours
Harz Jig.
Richards Jig
Relative Grades of Concentrate
Harz Jig
Richards Jig.
Tons of Ore Treated per Sq. foot of Jig Screen Surface.

Here is shown the relative size of jig screens. Note the difference, then see what follows.

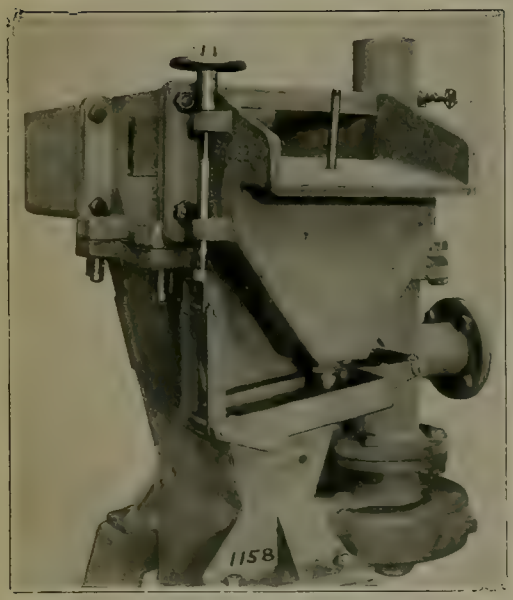
And here are the relative capacities.

And here is the relative grade of concentrate.

And here the tons of ore treated per square foot of jig screen surface.

And here is the jig itself, the

RICHARDS PULSATOR



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EDITORIAL STAFF:
T. A. RICKARD, Editor
CLEVELAND DE KALB, Associate Editor
M. W. von BERNEWITZ, Assistant Editor

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C. T. HUTCHINSON, Manager
E. H. LESLIE, 600 Fisher Bldg., Chicago
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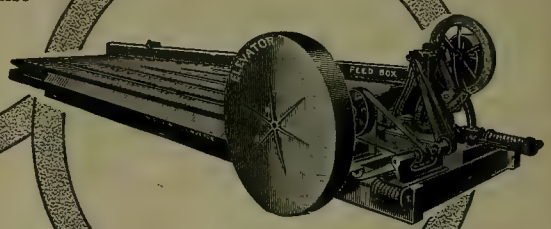

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LYING on a cot, wounded, after a glorious fight, a soldier boy said: "Tell the folks at home that we may not all come back, but that we are winning the war." They are, God bless them!

EXPORTS of silver during the first six months of the current year amounted to $139,000,000, as against imports of $70,000,000. Most of the outgoing metal went through San Francisco westward to settle trade-balances in the Orient. The silver miner is doing good work for the Nation.

WE are requested to state that the Field Artillery is in need of officers. This is a branch of the Army particularly suitable for mining engineers. A training-school has been established in Kentucky. Candidates must be between 20 years 8 months and 40 years of age. Applications should be addressed to the Field Artillery Central Officers Training-School, Camp Zachary Taylor, Louisville, Kentucky.

FOR the third time George Graham Rice, whose real name is Jacob Simon Herzig, has been indicted for fraud, this time in New York. He has been in prison twice for similar offences in connection with the raising of money for mining schemes. We have but scant sympathy for his dupes, of whom there must be thousands, because the true character of his financial operations has been exposed again and again. It is astonishing that a man so infamously known should have been able repeatedly to create a large and successful promoting business.

DECIMAL systems are gaining ground. Although the English-speaking peoples have been disinclined to adopt the metric system, it is interesting to note that the idea was accepted for American coinage long ago and it is now about to be introduced into the coinage of Great Britain, where a bill to that effect is before Parliament. It is proposed to continue the sovereign and the florin, which is two shillings or one-tenth of a sovereign; in addition, a new coin, equal to one-hundredth of a sovereign, and equivalent to the American nickel, is to make its appearance. Moreover, a new farthing, equal not to a fourth, but to a fifth of the penny, is to be minted. Presumably the new penny will be a two-hundredth, instead of a two-hundred and fortieth of a sovereign, making it therefore one-twentieth of a florin. All this is in the direction of scientific progress.

CONTROVERSY seems to have arisen between the chemists in charge of sulphuric-acid manufacture and a committee representing the jewelers, over the commandeering of platinum. Mr. B. M. Baruch stated emphatically last January that "the shortage of platinum in the production of explosives is such that it is necessary for the Government to have command of every bit of platinum that can possibly be had." He requested that the further manufacture of platinum jewelry be discontinued. This would have necessitated finding other employment for 10,000 workmen engaged in that industry, and, as a result, a clash of interests has taken place. It seems certain that the Platinum Section of the War Industries Board has not enforced orders in keeping with the earlier declaration by Mr. Baruch. This soon must cause serious embarrassment in the production of munitions. The needs of a growing army cannot be met without an increase in the amount of sulphuric acid. Importations of pyrite are restricted because of insufficient shipping, and the domestic output will hardly make good the deficiency for many months to come. Also the construction of chamber-plants requires so much time, and demands so many laborers, both in the supplies needed and in the actual erection, that the only certain remedy is to increase the production of contact-acid, and for this purpose no satisfactory substitute for platinum has been found. Persistence in the manufacture of the most wasteful of luxuries on the plea that it would effect a small group of workmen is trifling with the welfare of the Nation. Skilled metal-workers of any kind can find proper use for their talents in the necessary duties of the hour. We surmise that it is the jewelers, facing a loss of manufacturing profit, rather than their employees, who have been responsible for the effort to hamper the commandeering of "every bit of platinum that can possibly be had."

SHORTAGE of electric power in California, due in large part to the diminished rainfall last winter, makes it necessary that all users of current exercise rigid economy. The California Railroad Commission believes that careful conservation will obviate the neces-

sity for applying priority regulations. Accordingly, the power administrator, Mr. H. C. Butler, has issued a circular asking the managers of gold mines and dredges in the central and northern parts of the State to arrange as far as possible to operate their heavy loads between the hours of 10 o'clock at night and 7 in the morning. This is a reasonable request, and compliance with it may avert the necessity of restricting further the distribution of electric energy. At one time the power companies had prepared a priority list that would have discriminated against the gold industry, but the recent ruling of the War Industries Board, recognizing gold mining as a war-essential, removes the danger of such adverse action. The gold miners, however, will be obliged to pay an additional two mills per kilowatt-hour, in accordance with the decision of the California Railroad Commission allowing a general increase of rates. Hitherto power used for hoisting cost 1.5 cents and for other purposes in connection with the mines 1.25 cents per kilowatt-hour, with the exception of the Electra district, which includes the Mother Lode counties, where the price was 0.826 cent on a rated capacity exceeding 100 horse-power. The charge for gold dredging has been 0.75 cent per kilowatt-hour. In all cases the current is delivered and metered at the primary voltage, and the consumer is required to provide the necessary transformers.

THE wiles of Germany stop not at the sacrifice of exalted personages if thereby the political objects of the rulers may be advanced. The world is now persuaded that the murder of the Archduke Ferdinand was a palace plot to entangle Serbia and create a pretext for the casus belli universi. This gives a clue to the mystery of Hindenburg, with the difference that he becomes the goat, in the ancient occult sense, because he was first of all a *hinderung* and a *drohung* to the royal house that constitutes, as Hegel said, the 'apex of the State.' The Field Marshal had proved himself the master brute, the man of the earth earthy, with the force to make savagery worshipful by those who translate might into majesty. In other words, Hindenburg's campaigns had led to a preponderance of success over failure; he had driven for the ends that accorded with the national aspirations; the dominance of Germany was more to him than spectacular victory; thus in his utter materialism he expressed more definitely than Kaiser Wilhelm the popular German ideal. The spectacular in war is a royalist tradition, an imperial necessity from the remotest epochs. The impulse to figure in it is one that autocratic rulers cannot resist for long without sacrifice of some part of that divinity that hedges kings. Thus we hear of the anxiety displayed by the Crown Prince to put the seal of martial victory on his royal pretensions. He fretted under the stagnation of peace, which promotes the decay of thrones, and then, in war, he chose Verdun as the conspicuous fortress against which to hurl his army and to try to demonstrate his prowess. A fearful peril inheres in royal failure, and when the Hohenzollern failed, it was ominous to note that the people had been building a statue, like an image of devouring Baal, in honor of the hero who had given promise of augmenting the prestige of Germany. It was recognized that Hindenburg had achieved a degree of popularity that menaced the ascendancy of the Emperor; a little more and he might be able to dictate as another Bismarck, with the added strength of personal military success as his warrant. He is said to have counselled demonstrations on the West sufficient to retain the option there of offensive action, and at the same time to drive hard at Italy, at Greece, and down the Euphrates, while Russia was being subjected to a mixture of political and military penetration; then suddenly he faded into mystery. The master must score first, the idol must prove to be altogether of clay and lacking imperial vision. First Ludendorff was brought forward as the supreme and willing servant to confound his rival; next Mackensen is called to justify Caesar. Meanwhile Hindenburg flits from death to life and back again; at one time he is reported ill, and again he is merely taking a well-earned rest. This doubt regarding his fate is supposed to exert a favorable psychological effect on the Allies, for the German really believes himself to be a psychologist. It is well for us to realize these jealousies and dissensions among our enemies. The barbarian plunderers are not united in spirit as are the men outside that are fighting for lofty ideals. Who has heard even a whisper of pique between Joffre and Foch? Who has heard of Haig sulking in his tent, or of Pershing quibbling about precedence? They are dividing the labors as true democrats should, for they have no master with whom to curry favor except the people whom they represent in the struggle to maintain equality of opportunity and liberty for all men throughout the world. There is no harmony among the powers of evil, but among those that fight for the right exists a bond that makes them one and invincible.

The Status of Gold

Governor Boyle of Nevada has called a conference for August 12 and two following days to meet at Reno "for the purpose of discussing the ways and means to stimulate the production of gold in the ever-increasing operating costs, which at this time actually threaten the industry in the West." This conference is being organized in co-operation with the American Mining Congress and with the support of numerous Western metal-producers' associations. We hope it will be well attended, for it is most timely and important. Gold mining is menaced not only by the increasing cost of operation but by public ignorance of the first principles of economics. Briefly, the winning of gold from veins and placers is threatened by the advance in wages, which, since 1914, averages about 35%, and by the increased cost of supplies, ranging from 10 to 100%. The total cost of production has increased 33 to 40% in four years. Thus a mine operating at a cost of $3 per ton and producing $4.50 worth of gold per ton in 1914 would now operate at a cost of $4.20, which, in the face of increasingly unfavorable conditions,

leaves only a precarious profit. Meanwhile the purchasing power of gold has declined. Economists say that 'the cost of living' has doubled since 1914, but such a statement must not be taken literally, for it means only that the average price of a number of staple foodstuffs has been doubled, which is a very different thing from the total expenses of the ordinary citizen, because civilized "man does not live by bread alone"; his expenses include rent, clothing, lighting, water, and a number of other items among which articles of food represent about one-half—and the cost of *all* articles of food has not doubled, or anything like it—ask your wife. A fair estimate of the increased expenditure of the citizen since 1914 is 40%. Manifestly, if living expenses had doubled, it would be impossible for the laborer or artisan, not to mention the professional man, to escape bankruptcy. We would be facing economic chaos. However, the cost of living in most cases has risen more than wages, especially to the gold-mine laborer, whose pay has advanced from $2.50 to $3.25, or 30%, as against the advance to the copper-mine laborer, from $3.00 to $5.50, or 83%. Hence the migration from gold mines to copper mines, withdrawing the best labor of the mining districts most unfavorably affected by the War. The wages of the copper miner have risen faster than his living expenses, because he is producing a metal the value of which has appreciated abnormally, whereas the gold miner's pay has risen less rapidly than his cost of living. This means that a further tax—in the form of a bigger payroll—is inevitable if gold mining is to persist. The remedies suggested are various. The Priorities Board now rates gold mining with the metal-mining industry in general. In answer to a request for a definition of the status of gold mining under the recent order of the War Industries Board that placed it on the priorities list, Mr. B. M. Baruch telegraphed that the classification applying to gold mining gives it the same position as "coke-oven plants, mines, smelters, furnaces, rolling-mills, wire-drawing mills, pipe and tube-mills, employed in the production of fuels, metals, and metal products." The classification, which becomes immediately effective for the industry, is an amendment to circular No. 4 of the Priorities Division of the War Industries Board, section one, following subdivision *O* of section eight, page five, and covers the operation and maintenance of existing plants, but no new construction, expansion, or replacement. Gold mining, as yet, has been accorded no special favor at Washington. A gold mine requires only one car of freight monthly per $50,000 worth of gold. Immunity from Federal Taxation, relief from increased freight-rates, and the like, will help, but they will prove wholly inadequate. The suggestion to change the weight of gold in the monetary unit, or, as it is vulgarly and inaccurately phrased, "to raise the price of gold," is unworthy of serious consideration. After all, as Mr. Benedict said in our issue of August 3, "the price of an ounce of gold is an ounce of gold." A much better proposal is to pay a bonus on the gold as it is produced at the mine. Such a bonus has been paid on other metals: on lead in Canada, on copper in Russia. It is a practicable method of stimulating production, and we recommend the idea to the conference at Reno.

The Metal-Dealers Clique

On another page we publish the chronology of the dealings between the Minerals Separation company and Beer, Sondheimer & Co. It shows how, after Great Britain and Germany had gone to war, a British company continued to do business with two Germans that had been representing a German firm in New York; and how, even after the New York branch of the German firm had been black-listed by the British government, this British company entered into agreements with these same Germans. That they took steps, after the War had begun in Europe, to become naturalized in the United States is a fact the value of which we do not need to appraise. They still remained 'enemy-aliens' to a British company. What value is to be attached to their belated naturalization as American citizens is indicated by the report of Mr. A. Mitchell Palmer, the Alien Property Custodian, who, on July 22, took over the business of Beer, Sondheimer & Co., Inc., this being the camouflage corporation organized in August 1915 for the purpose apparently of overcoming sundry technical difficulties incidental to the War. Mr. Francis P. Garvan, director of the Bureau of Investigation, reported to Mr. Palmer that the New York corporation "was organized upon the advice of the German concerns," to which all the capital stock of the American corporation was issued. Messrs. Benno Elkan and Otto Frohnknecht became president and vice-president, respectively, "receiving exactly the same salary and the same percentage in the net profits of the business as was provided for them in the 1912 agreement with the German firm." They thought to cover their tracks by such simple devices, besides making contradictory statements as to the purchase of the German holdings. Mr. Garvan says: "It appeared also that for the sum of $240,000 Elkan and Frohnknecht purchased a property that during the year in which they purchased it yielded a profit of $2,000,000." According to the Alien Property Custodian, the Beer-Sondheimer company owned half of the National Zinc Co., and the entire stock of the Cuba Copper Company, the Cuba Copper Leasing Co., and the Norfolk Smelting Co., besides 30,000 shares of the Minerals Separation American Syndicate, Ltd. This firm of Beer, Sondheimer & Co. is reported to have assets in excess of $5,000,000, whereas L. Vogelstein & Company, annexed by Mr. Palmer on the same day, is credited with assets of over $9,000,000. Both are described as "German-owned metal concerns closely connected with the Metallgesellschaft of Frankfurt-am-Main," that is, the great metal-buying octopus whose tentacles were pictured in a chart published by the Federal Trade Commission and reproduced in our issue of January 19, 1918. It consists of an interlocking group consisting of the Metallgesellschaft, the Metallbank, and Henry R. Merton

& Co., the founder of which was Philipp Abraham Cohen, the English name of 'Merton,' like the word 'American,' being adopted for strictly business purposes. Mr. Ludwig Vogelstein is a naturalized American; for many years he has represented Aron Hirsch und Sohn, of Halberstadt, Germany. The business done during the last three years has averaged $70,000,000 per annum. Mr. Vogelstein drew 15% of the profit, besides an interest in the firm's business in Germany. In December 1916, Mr. Vogelstein formed a New York corporation, capitalized at $5,000,000, to take over the property held in partnership with Herr Aron Hirsch, claiming that his agreements with the German firm were terminated, but Mr. Palmer did not accept the explanation, contending that "the interest of Aron Hirsch und Sohn in the American business has continued to date and that except for Mr. Vogelstein's participation in the profits, all the assets of the American concern belong to the German firm." Mr. Garvan discovered that the Vogelstein company had stored large quantities of copper for delivery after the War to the Hirsch firm; he also ascertained that the latter had guaranteed notes for several hundred thousand dollars given to a New York bank by L. Vogelstein & Co. Mr. Palmer has taken control of the business and is in a fair way to learn more about the intricacies of the metal trade. The Vogelstein company, on behalf of Aron Hirsch und Sohn, controls large holdings of stock in the United States Metal Refining Co. and the American Zinc, Lead & Smelting Co., which, in turn, controls the Wisconsin Zinc Co., American Zinc Co. of Illinois, the American Zinc Co. of Tennessee, the American Zinc Ore Separating Co., the American Pipe Line Co., and the Oglesby Gas Co. Assuredly 'American' is a good old name, but sometimes it is overworked. Concurrently, Mr. Palmer has published sundry items of information concerning the American Metal Co., whose business passed into his safe hands a short time ago. Of the 70,000 shares of the American Metal Co., 15,180 shares are owned by the Metallbank at Frankfurt and 18,180 shares by the Metallgesellschaft in the same famous city. This official statement may be compared with the statement made by Dr. Otto Sussman in a letter published in our issue of March 16, 1918, in which he had the effrontery to state that 97.7% of the stock of the Compañia de Minerales y Metales, with which he was identified, was held by the American Metal Co., "which is controlled by British and American interests." According to Mr. Palmer, the American Metal Co. completely owns the American Zinc & Chemical Co., Bartlesville Zinc Co., South American Metal Co., and four other companies of less importance; it also has "large holdings of stock" in the Ohio & Colorado Smelting & Refining Co., Compañia Minera de Penoles, Compañia de Minerales y Metales, Compañia Metalúrgica de Torreón, Compañia Minera Paloma y Cabrillas, Compañia de Combustibles Agujita, Fundición de Guayacán, the Balbach Smelting & Refining Co., and the Nichols Copper Co. This is a formidable array, but, large as it is, it is not complete. These German firms are said by Mr. Palmer to have "dominated the metal market of this country in such manner that they were enabled to sell copper, aluminum, zinc, and other metals in Germany at a price much lower than the American consumer had to pay." It is announced officially that "in taking over these and other metal businesses the Alien Property Custodian has smashed for all time the German control of the metal industry in this country." We hope he has. The publicity given to their ramifications will help greatly. The War has removed the lid. Our readers will remember that the first exposure of the metal-dealers' clique was made at Adelaide, South Australia, on December 12, 1914, in court proceedings against Francis H. Snow, a metal-buyer whose office was raided and whose letters disclosed his correspondence with the three firms now in Mr. Palmer's care, with Aron Hirsch & Co., and with Henry R. Merton & Co., in London, then the agents of the Metallgesellschaft, but since reorganized by order of the British government. Those letters indicated the interlocking of interests and the efforts made to get copper to Germany after hostilities had begun. As intimated before, we regard this clique as a non-national coterie co-operating to make money at the expense of the metal-producers, by the control of the channels of sale. That it was German was a coincidence, fortunate in so far as the War interfered with its machinations; that it was Jewish is due largely to the nature of the business, which renders it attractive to the Hebrew mind. We question whether it was organized as a part of the Pan-German scheme; we think that, in its inception, it was non-national, just plain 'peeziness,' always willing to deal with any customer, and that it found Germany the principal buyer in those years of preparation that preceded the outbreak of military bestiality in 1914. Whether the metal-dealing clique was a phase of German penetration or only another manifestation of organized non-national cupidity, we leave it to others to decide, but we do insist that it was a menace to the mining industry and it will continue to be a menace until it is completely stamped out. The transfer of power from German hands is highly satisfactory, but it must be noted that Britons and Americans participated in the operations of the clique before the War and it is imperative that the whole method of selling metals—more particularly of fixing the prices of metals—be analyzed and exposed ruthlessly. It is stated that the metal businesses seized by the Government are to be sold by the Alien Property Custodian. This will involve several large and important transactions, under cover of which the assets of these German firms may pass to other groups quite as likely to make an effort to establish a control hurtful to the mining industry. Patriotism is foreign to speculation in metals. The mining industry has too long been at the mercy of the metal-selling agencies. The American Institute of Mining Engineers or the Mining and Metallurgical Society of America could do much to justify their national names by making a serious effort now to investigate and rectify the matter, in co-operation with the Alien Property Custodian.

The Menace to Gold Mining

The Editor:

Sir—In your issue of July 20, you discuss the necessity for sustaining the production of gold, and ways in which it can be accomplished. In the same issue W. J. Loring describes the difficulties under which gold mines have been operating, and pleads for their classification as an essential industry. Now that the War Industries Board has announced its decision to place gold mining on the essential list, one important step has been taken toward the relief of the industry, and it remains to secure the financial assistance that will be necessary to cause the resumption of work by low-grade mines that have been forced to suspend operations on account of high operating costs, and to stimulate production from all mines.

Mr. McAdoo has stated that at no time has this country so much required the largest production of gold as at present, and that the reason for this requirement is to sustain the credit of the Government. In other words, he stated that the demand for gold is greater than ever before, and that it is needed in the financial operations of the country. Its value to the Government with respect to credit has increased, but its price has remained stationary. Its value to the Government is greater than its price of $20.67 per ounce, in that it has the additional value, greater now than ever before, that an ounce of gold in the U. S. Treasury will sustain the Government's credit for more than $20.67. It is this additional value that will justify the Government in paying a bounty for the production of gold.

There are two conceivable ways in which the Government can stimulate the production of gold: It can go into the business of prospecting and mining and produce the gold itself. The success of this method would be very doubtful, and it can be predicted with certainty that gold produced in this way would cost the Government more than $20.67 per ounce. The alternative is to pay miners $20.67 per ounce for gold produced, and in addition to this allow a specified amount toward the expense of producing it. This would be a bounty for the finding and winning of gold, and not an increase in its price, and such a bounty should be restricted to gold produced currently from mines in the United States. In my opinion, the payment of a bounty would be far more effective than the mining of gold directly by the Government.

The suggestion that certain privileges, such as exemption from taxes, be granted gold mines in place of a bounty, has the defect that it would not help the small producer or the one that produces gold at a small margin of profit, in the same proportion that it would help the larger, more successful, producer; whereas, as far as the Government is concerned, gold won at no profit to the producer is fully as useful in the Treasury as gold produced at a big profit. If a bounty is placed on gold, much of the increase in production would probably be made by small producers and prospectors from small or low-grade veins, and placers, that cannot be profitably worked under present conditions. The exemption from taxes would be of very little help in stimulating production from this class of deposits. By placing a bounty on the production of gold, the additional cost to the Government would be in proportion to the results obtained, and would be divided among producers in a like ratio.

There are precedents for the payment of a bounty or bonus of this nature. The bounty on coyote scalps comes most readily to mind. The killing of predatory animals is beneficial to the State, and the skins sell at a good price, but in addition to this, several States pay bounties in order to accelerate their extermination. The subsidizing of shipping, and of the exportation of manufactured articles, as applied in some countries, are instances of a somewhat similar practice. Even the payment of interest is in some degree of this nature, for, where we pay money for the use of borrowed money in order to facilitate our financial transactions, the Government would be paying money to get the use of gold to facilitate its financial transactions. In paying a bounty for the production of gold, the Government would simply be subsidizing the gold industry in order to keep it alive, and to maintain the production of an essential commodity.

Whatever help is given to gold mining at this time must be in the nature of additional payment, either directly or indirectly, for gold produced. Whether gold production can be stimulated indefinitely in this way without impairing our financial structure, would require a closer analysis in the light of economic and financial science than I am prepared to give; but as I see it now, the effect of paying a bounty would be simply to reduce by that much the additional credit that could be erected upon the gold produced under this plan. This might prove eventually to be a waste of credit, but as a war measure it would be no more wasteful than shooting expensive shell at the enemy. It would be an expense rather than a waste.

My suggestion as to the way in which the bounty plan

could be applied is, that the gold would be sold to the Mint at $20.67 per ounce; that the Mint would pay for it as usual, and at the same time give a receipt for the gold; that upon the presentation of the receipt together with proof that the gold was produced from domestic ore by the seller, the U. S. Treasury would pay the bounty. As to the amount of the bounty, it might well be $10 per ounce.

J. A. BURGESS.

Oatman, Arizona, July 26.

The Editor:

Sir—I would like to call your attention to the following views regarding the mining industry in Colorado. I am told by parties, in a position to know, that most of the other gold and silver mining States are in pretty much the same shape. About all the average mining man has left now is an optimistic hope for the future. The present is certainly the darkest period through which the mining industry has ever had to pass, and the general public doesn't realize it. Slowly but surely economic conditions, plus the War, have strangled all but the larger operators. Colorado is essentially a mining State of small operators depending on gold, silver, lead, zinc, and only to a minor degree upon copper as a basis for the industry. Gilpin, Boulder, and Clear Creek counties, Cripple Creek, and the districts of Rico, La Plata, Ouray, Red Mountain, and Silverton in the San Juan are producing less than ever before. I have just returned from a month's trip, and I venture to make the statement that if production continues for the next six months as it has during the past four months, Colorado will not produce more than 70% as much as it did last year, and last year its mineral production fell off nearly $8,000,000 in spite of the so-called high prices for metals.

I have talked to a great many of the smaller operators throughout the State, and they are all discouraged. A good many have quit mining and many more tell me that unless conditions change soon, they will be forced to do so. Very few have made any money during the past two years. Many have kept going, as they felt they were rendering the country some service, and were in hopes that conditions would so change that they could stay with the game and break even.

Prices received now for metals seem relatively high when compared to those received in 1912, '13, and '14, but when labor efficiency, cost of supplies, freight-rates, and added taxes of this year are compared with figures for preceding years, it is seen that all the advantage lay with the prices then obtaining. Even then the miner was not making money, and there was but small encouragement for others to become interested in the industry. Certain it is that the little fellow, who in the past has developed the prospects into mines or to the stage where they might be attractive to the larger mining corporation, has been and is being crowded out. The prospector is almost a thing of the past.

This condition has not been caused by the War. It has been taking place for a number of years, and war conditions only accelerated it. Many explanations have, from time to time, been advanced to explain it, but the fundamental reason is that small-scale mining does not pay enough to attract new capital. Therefore, if the industry is to continue, the average price of metals must be higher than in the past. The plain truth of the matter is that for many years the average mining man of this State (I think the same is true of others) has sold his product for less than it cost to produce it. It is true that the larger mining corporations can make a profit (and have) at a lower price than the small operator, and that they also produce about 70% of the metals; they also have been the deciding factor in making the metal quotations, but as I see it at this time, this has no bearing on the small operator.

The large mining corporation never has been successful, and probably never will, in the development of properties from the prospective to the productive stage. There is too much inherent risk in this part of the work to make it attractive to them, but it is on this part of the industry that the future of mining depends, and in some way conditions must be so changed as to make a larger percentage of it profitable, thus removing some of the risk. It is obvious that this is the part of the industry that must be encouraged and stimulated.

The whole of the matter, in my opinion, resolves itself into this: Assuming that the larger mining corporations produce 70% of all the metals and the smaller operators 30%, if the quantity of metals produced by the larger companies is not sufficient to meet the demands of the market and Government, at this time, then the prices must be so adjusted that the men who produce the 30% can at least have a chance to break even, and this is something they have not now. It seems to me that, at this time, in order to have a plentiful supply of metals, the Government can well afford to advance metal prices to a point where the individual producer can make a profit so that he can stay with the game. The idea is not new. It has been advocated before, and objected to principally upon the ground that it would only enable the larger corporations to increase their profits to an unreasonable extent. Well, what if it does, so long as their excess profit can be taken away and turned back to the Government through income and excess-profit taxes? What's the difference how much they make when they don't keep it? This idea is being applied to the coal industry. The small operator is kept alive during a critical period. Why not apply it to the metal-mining industry?

I believe that the time is in sight when the ratio of the value of metals in metallic money will be the same all over the world. That is, some world-standard coin containing so many grains of gold or silver must be the standard for the whole world and be recognized as legal tender in every civilized country, so as to simplify and stabilize the world's business, and that such coin will have a higher value per grain of gold or silver than any coin has now.

Objection has been made to advancing the value of gold and silver on the score that this action would upset financial conditions all over the world. Is it not a fact that conditions are already upset, financial more than all others? Investigate the rates of exchange. Is it not also a fact that the people of the world must adjust themselves to the conditions of the times, and that while they are in the mood to make this adjustment is the time to make it? Certainly no one can deny the fact that we are adjusting ourselves to conditions undreamed of a year ago and we are doing it without complaint.

M. T. Chestnut.

Denver, July 17.

Formulas for Mine-Valuation

The Editor:

Sir—In your issue of June 29, K. F. Hoffmann disapproves of the formula which was developed and proposed to be employed in the valuation of expected mine dividends as given in my article in the Mining and Scientific Press of May 18. He states that, according to the definition of a 10% investment (the rate that I assumed in my examples) the Hoskold formula is not in error; but, as I stated in my paper, it is not sufficient to define a 10% investment in a wasting asset, such as a mine, as one that will pay the investor 10% per annum on his investment and return him his capital at the end of the period of the investment, for there are not one or two but several ways in which the dividend may be apportioned between interest and amortization of the investment that will fit Mr. Hoffmann's definition. According to the formula employed there is a large difference between the various values that may be thus obtained. Obviously some addition to his definition is required before an exact solution can be reached, and according to my view 10% interest should be paid only on the unreturned capital, and the amount of the unreturned capital is the amount originally invested less the amount in the sinking fund.

According to my definition and the formula deduced therefrom, the present value of an annual dividend of $1000 for the term of 10 years, paying 10% per annum on the investment, with the sinking fund accumulated at the rate of 4%, is $6591.37. By the Hoskold formula the value of this investment is $5455.81. Further, we may regard the dividends as payments on an installment-loan by which each dividend pays the investor 10% on the investment, with an additional amount, which annually reduces the principal in each year 10%, being paid on the reduced principal. This gives a value for the investment of $6144.57. This is a common transaction by which banks loan money, and corresponds to accumulating the sinking fund without interest to the amount of the original investment, and requiring the mine to pay interest only upon the unreturned capital; or we may regard each dividend of $1000 as a separate investment, each dividend having a present value at 10%, according to the number of years its payment is deferred, under which hypothesis the value of the example taken is likewise $6144.57. (See Hoskold, p. 75, for table of factors.)

We may require the mine to pay 10% interest on the original investment during the term of 10 years, and return the investment in full without the aid of 4% interest on the sinking-fund; by which a value of $5000 is obtained. We may require the mine to pay 10% interest only on the capital unreturned, providing that the unreturned capital is the original investment less the actual amount paid into the sinking-fund without interest accumulations, and require the sinking-fund with 4% interest to amount to the original investment at the end of the term. This gives a value of $6498.39.

Here are six ways, giving five different results, in which the dividend of $1000 per annum for 10 years can be regarded as paying 10% interest on the capital and returning the capital to the investor, all of which agree with Mr. Hoffmann's definition. There are several others which are not illogical. Obviously this definition is not exact; and I believe the additions I gave to this definition in my original article make it exact and allow of a correct solution, and that I have further shown that the Hoskold formula does not give the correct solution.

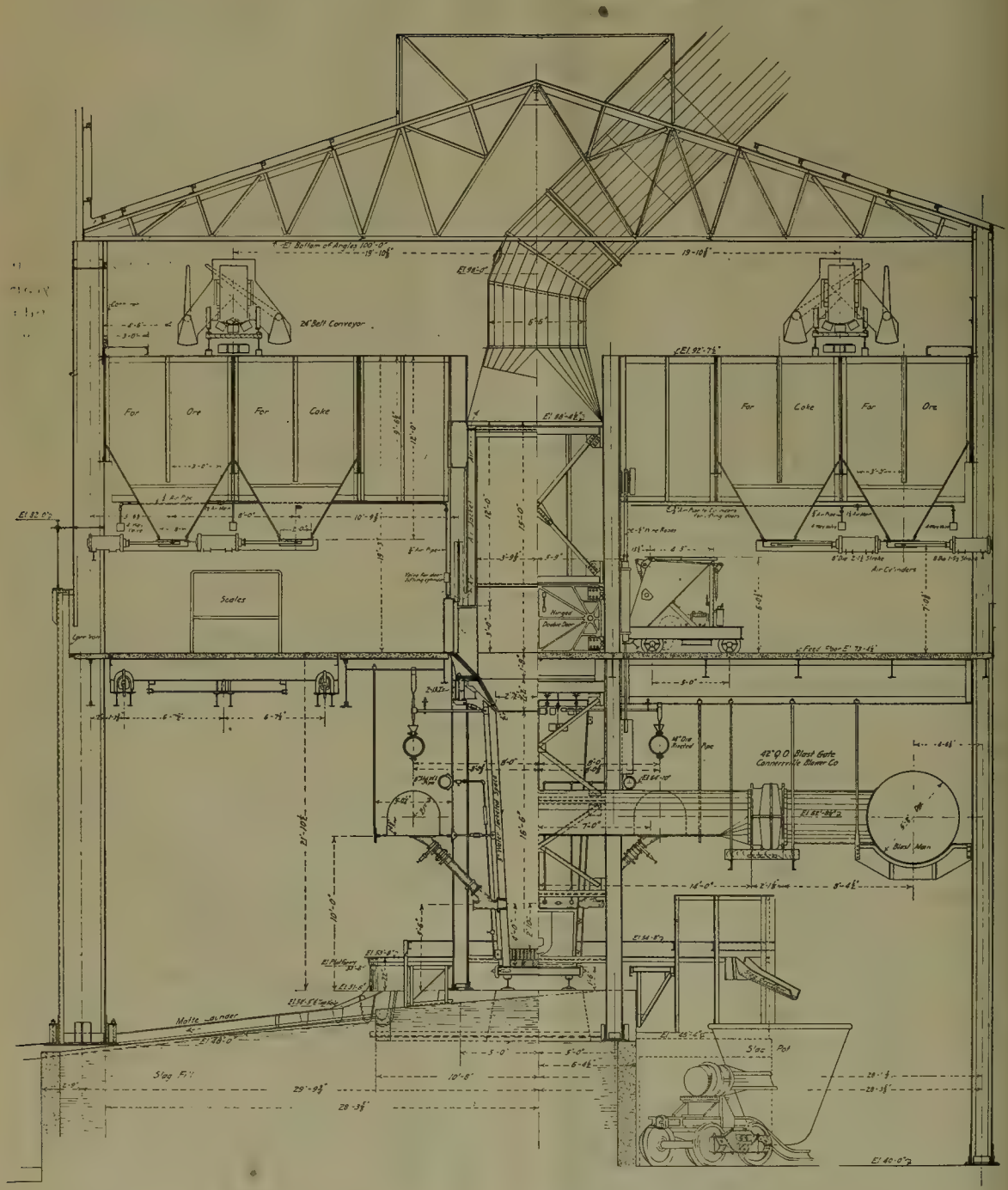
In the conclusion of Mr. Hoffmann's letter he states that an investor in mines should be allowed more than the ordinary rate of interest common to bonds, otherwise the investor would buy bonds and avoid the risk necessarily taken in mining stocks. To this I agree, but I do not see that it can be taken as an argument for the use of the Hoskold formula rather than another, but I cannot agree with him if he intends to argue that the Hoskold formula should be employed because it gives a result lower than the correct one, and that the difference should be allowed the investor as a premium or bonus, because under my view the formula employed should be theoretically correct. A premium or bonus may be justified, but an investor should be told the amount or rate of the expected bonus, rather than have it concealed by faulty mathematics.

It would appear probable, when it became recognized that a mine was a wasting asset and, therefore, that provision should be made for the return of the capital to the investor, that, without close mathematical analysis, engineers had merely turned to the formulas employed for bond valuation in which but a single type of sinking-fund is ordinarily used. However, on close analysis, it appears that an investment in a bond is not exactly parallel with an investment in a mining stock, nor is an investment in an installment-loan. The mathematical valuation of a mine investment differs from that of nearly all other investments, and it should be so recognized.

W. W. Whitton.

Oakland, California, July 29.

Infusorial earth is used for making metal polishes, for pipe and boiler coverings, and for porous bricks.



CALUMET & ARIZONA BLAST-FURNACE; END ELEVATION AND CROSS-SECTION

SMELTING PLANT OF THE CALUMET & ARIZONA MINING CO., AT DOUGLAS, ARIZONA

The Calumet & Arizona Smelter

By COURTENAY DE KALB

The smelter of the Calumet & Arizona Mining Co. is not a custom plant, yet the exigencies of fluxing and of the development of other enterprises have led to an extension of its zone of attraction as far as to Lordsburg, New Mexico, in an easterly direction, to Ajo in the west and to Jerome in the north. The higher grade New Cornelia ore, which is very silicious, contains approximately 4% copper, present mainly as carbonate and silicate, and this is used as reverberatory fettling and as a flux for the converter charges. The daily consmuption of this material is 150 tons. An equal quantity of a similar ore from the 85 Mining Co. at Lordsburg is used for the same purpose. The main supply of ore, however, is from the company's great mines at Bisbee, or, more specifically, at Warren, 25 miles to the northwest. The daily deliveries from this source nominally amount to about 2400 tons, averaging about 5% copper, 18% silica, and 28% sulphur. The Shattuck mine above Bisbee, of which it may be said with more truth than fiction that half-hearted commendation given by economic geologists and engineers, with consequent hesitation on the part of possible buyers, forced the owner to develop the property himself and to scramble through hard times to financial affluence, contributes 500 tons per diem of sulphide ore assaying 5% copper. In September, at the time of my visit, the smelter was treating about 1500 tons of ore daily, which is less than half its capacity. This deficiency of ore was due to the shortage of labor at the mines. The labor-problem, however, does not now embarrass operations as it did at the time when the pro-German propaganda was concentrated so strongly upon producing disaffection in the ranks of the miners. The Calumet & Arizona ore is variable in character, as are all the other ores of the Warren district. In depth there is an abundance of sulphide ore; there are also large bodies of carbonate and other oxidized ores, sometimes not conformable to the usual and supposedly logical position of oxidized ore above the sulphides; in places that order is reversed at Warren and at Bisbee. This explanation will serve to accentuate the fact that deliveries of mixed high-copper ores of both classes are made to the smelter. The ratio between them is about 1 of oxide-ore to 2.5 of sulphide. The thing, however, that it does not reveal is the interesting fact that, in the development of the large reserves of high-grade ore, that is, ore containing over 5% copper, a much greater tonnage of low-grade sulphide ore has been put into sight. For such ore there is an extremely limited market at present, although its composition is favorable for the manufacture of sulphuric acid. The sulphur content exceeds 45%, and it assays about 2% in copper. The Calumet & Arizona smelter is one of the few Western plants that has a sulphuric-acid annex. This has a capacity of 200 tons of acid per day, and if it be essential for purposes of war to produce more of this commodity it is plain that it would be advantageous to enlarge a going plant, where there would be no extra over-head expense, and but little extra labor-cost. It would be possible, under properly co-ordinated transportation systems, to take acid from such a plant to Mississippi Valley points, if not farther east, at least to the extent involved in the duplication of the Calumet & Arizona works. With lead at moderate prices, this would seem to be a favorable moment to undertake such a duplication if required as an

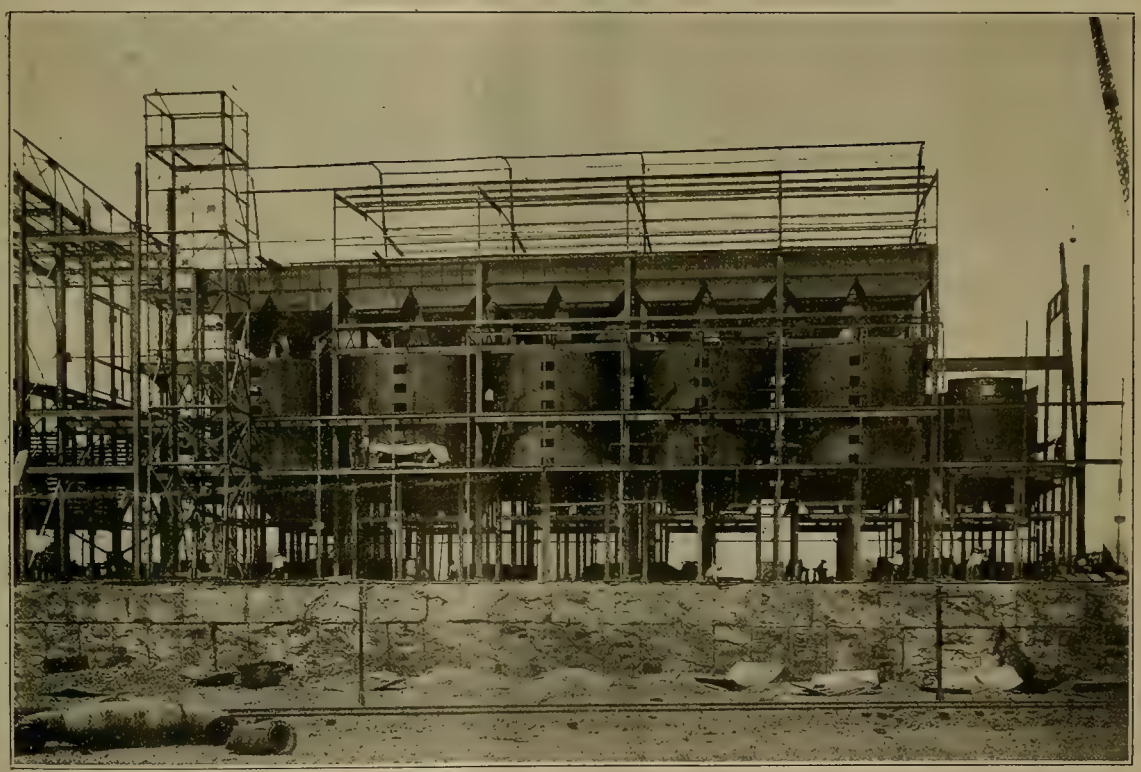
emergency measure. It is interesting to note that the plant now has a large battery of Herreshoff roasters, of which nineteen are discharging their sulphurous fume into the atmosphere, while only five are connected to the acid-making plant; therefore no delay would be occasioned for the manufacture and erection of this part of the plant. Neither would it be necessary to draw upon the low-copper pyritic ore, which would still remain cheaply available for acid-making in the East if the Government can arrange for its transportation. Too much stress cannot be laid upon the fact that, while officials in Washington are calling for more pyrite and more sulphur to make good the deficiency of Spanish pyrite, here are resources almost untouched, that need no more than suitable management of the transport-system of the country to become available for the general good.

The Douglas smelter of the Calumet & Arizona company lies about a half mile north-northwest from the Copper Queen smelter of the Phelps-Dodge Corporation. It represents a completely re-built plant, new from end to end, replacing the old works erected some years ago. The designing was done by the Calumet & Arizona staff under the immediate care of A. G. McGregor and C. H. Repath, with the advice and assistance of L. D. Ricketts, bringing his ripe experience to the problem as consulting engineer, and under the energetic direction of the general manager, Captain, now Major, John Greenway, to whom each enterprise in the betterment and development of the plants of his company becomes a pet on which he bestows an enthusiasm that imparts inspiration to his associates. The plant as it stands today contains receiving bins having a total capacity of 10,000 tons, a belt-conveying system for the same capacity per diem, a crushing, screening, and automatic sampling-plant of the most approved design, a bedding-yard operated on the Messiter-system, which first attracted well-deserved attention some ten years ago at Cananea, a great coke-handling and storage department for 10,000 tons, a battery of 24 Herreshoff roasting furnaces, as automatic in the feeding of ore, the discharging of calcine, and its conveyance to the reverberatories as such a plant can be; four 20 by 100-ft. oil-fired reverberatories, and two blast-furnaces of the Mathewson type, 40 ft. long by 4 ft. wide at the tuyere-section; also a converter department having six converter-stands, a McGregor skull-breaker, casting-machine, and the other accessories pertaining to a smelter. The power-house, as is characteristic of every plant upon which Dr. Ricketts lays his hand, is a model of efficiency, with no modern device omitted for ensuring the highest degree of economy. The steam is derived entirely from the reverberatory waste-heat boilers, and as there is a surplus of power over that needed for the smelter, this is transmitted as high-tension current for use in the mines at Warren. The power is developed with turbine alternating-current generators, taking steam at 80 lb. pressure, superheated by 60°. These turbine engines generate 3000 kw. at 80% power-factor, and 480 volts. Four No. 10 Connersville blowers are also direct-connected to steam turbines developing 240 hp. each. These furnish air for the blast-furnaces. In addition there are three Nordberg blowers having capacities in free air per minute respectively of 10,000, 12,000, and 15,000 cu. ft. These supply the converters, two turbines, three pumps, three Ingersoll-Rand compressors, and some minor apparatus. The machine-shop is adequate for all repairs to a plant of this magnitude. Fuel-oil coming by train from California is pumped to five well-protected storage-tanks having a capacity of 10,000 bbl. each. From these it is pumped, according to proper methods of safety-supply, to a measuring-tank for general distribution throughout the works where needed. The water-supply is abundant, the great Sulphur Springs valley being filled with desert 'wash' that is saturated by the precipitation from a large mountainous water-shed, so that two wells, 350 ft. deep, suffice for the needs of the entire plant. This water contains a large amount of sodium carbonate in solution, so that it is excessively 'soft' and deposits no scale in the boilers.

The steel ore-bins, 24 in number, are 37 ft. high, and the ore is delivered to them in 50-ton side-dump cars that are drawn on a 1½% grade from a spur of the El Paso & Southwestern railway. The width of the bins is 24 ft., and it will be seen from the plan that they are long and narrow, facilitating a side-discharge at the bottom, where the ore is delivered through arc-gates and fed by a traveling roller-feed hopper-car to either of two 30-in. conveyor-belts. These carry their burden to a feed-hopper placed between two 24 by 36 in. Blake crushers set front to front, having a capacity of 100 tons per hour each, crushing to 4-inch size. They were made by Chalmers & Williams. The crushers are cross-connected by chutes, are provided with grizzlies, and deliver the ore to a pair of 20-in. conveyor-belts that take it to the top of the sampling and screening-plant. A new set of bins has just been installed parallel to the older series, and a No. 8 gyratory, built by the Allis-Chalmers Manufacturing Co., has been erected at the end of the line of bins. The crushed ore from this machine will be handled by a new unit of the sampling-works. This addition to the mill is at present only equipped for handling the samples as they are cut from the main stream of reject, and for screening sulphides, the coarser sulphide being sent to the mixing-beds for the blast-furnaces, while the remainder is brought down to approximately ½-in. size for the reverberatory furnaces. The sulphides go to the Herreshoff furnaces to be roasted, and the oxide ores go direct to the charging-bins.

The handling of the ore through the mill is on a 2-belt system, each belt being capable of carrying the entire product of each unit. The arrangement is in parallel, so that no delay can ever occur on account of needed repairs. The 4-in. ore from the primary crushers is first delivered to a pair of Snyder samplers, consisting of a shallow cone, like a bowl set on edge, the ore-chute delivering to the lower inside rim, which is protected by renewable cast-iron liners. At one point in the rim is an open segment the width of the ore-chute. The bowl revolves, and during nine-tenths of the revolution the

JUNCTION SHAFT OF CALUMET & ARIZONA MINING CO., BISBEE, ARIZONA



*BATTERY OF HERRESHOFF ROASTING-FURNACES IN PROCESS OF CONSTRUCTION AT C. & A. SMELTER

*[This illustration appeared in connection with an article on the Calumet & Arizona sulphuric-acid plant in our issue of March 30, 1918, and by an error in publication was wrongly said to represent the Hegeler roasting-furnace.—Editor.]

machine is discharging reject to the main ore-stream, while for the remaining one-tenth of the revolution the whole stream is diverted to the sampling-unit of the mill. The Snyder sampler, which is excessively simple and efficient, cuts one-tenth of the stream, and by successive reductions the entire volume of 2400 tons per day is accurately sampled, each variety of ore being separately treated, and for every 100 tons there results a sample of 160 lb., which is sent to the bucking-room. It is reduced there to a proper size for the assay office by the usual series of gyratories, coffee-mill crushers, and disc-grinders. Although every ton of ore entering the smelter passes through the mill and is sampled, there is a by-pass after the first sampler, by means of which ore suitable for bedding can go direct to the beds. The coarser crushing is done by four 10 by 20-in. Blake crushers made by the Power & Mining Machinery Co. The final reduction of the ore to ½-in. size is effected in two Symons vertical disc-crushers, each of which has a capacity of 50 tons per hour. Throughout the plant trommels are used for screening.

From the sampling-works conveyor-belts take the coarse ore to the Messiter beds, the fine silicious ore to bins in the reverberatory department, the fine sulphide ore to the roasters, while the calcine from the roasters is transported by electrically-operated trains of larries to the reverberatory charging-bins. The roasting practice has been dwelt upon in a previous article describing the sulphuric-acid plant.[1] The furnace used is the latest design of the Herreshoff, built by the Pacific Foundry Co., of San Francisco. Each furnace has six hearths, exclusive of the drying-pan, 20 ft. 2 in. inside diameter, and 21 ft. 7¼ in. over all. It may be well to recall the fact that, of the 24 Herreshoff furnaces, only 5 are running 'closed,' that is, with the gas-discharge muffled by being sent through flues into the dust-chamber and thence through the nitre-house, Glover tower, and acid-chambers. The remaining 19 are running 'open,' the gases, which carry from 1 to 1.8% of the weight of the charge, passing through a dust-chamber 140 ft. long and 60 by 29½ ft. in vertical section, on their way to the stack. The walls of the dust-chamber are built of hollow tile. A baffle-wall is placed near the front and the rear of the chamber. The ore for roasting does not need to be reduced to ½ in., since disintegration on the hearths brings it down to proper size. About 25 to 30% of the ore for the 'open' furnace will remain on a ½-in. screen. In the ore roasted in the 'closed' furnaces the sulphur content is maintained a little higher, although the difference usually does not exceed 3 to 5%. The average is about 29% sulphur. Owing to the coarseness of the material a considerable amount of 'kernel-roasting' is done. The calcine issues from the 'open' furnaces with about 10% sulphur as against 13% from those connected to the acid-plant. The capacities of the 'open' and the 'closed' furnaces are respectively 90 and 70 tons each per diem, although the 'open' furnaces can be driven to the extent of handling 125 tons. An official statement by the company gives the average dry tonnage roasted as 96.4 per day, requiring 66,000 cu. ft. of air per minute, producing 80.5 tons of calcine and dust, volatilizing 70.1% of the sulphur, and giving 2.64% of flue-dust recovered. The typical analysis is as follows:

Roasting-Furnace Materials

	Charge. %	Calcine. %	Dust. %
Silica	16.6	18.1	16.5
Alumina	2.9	3.5	5.6
Iron (Fe)	31.7	38.2	28.7
Lime (CaO)	1.6	1.9	2.3
Sulphur	29.6	9.9	10.7
Copper	4.67	6.12	6.54

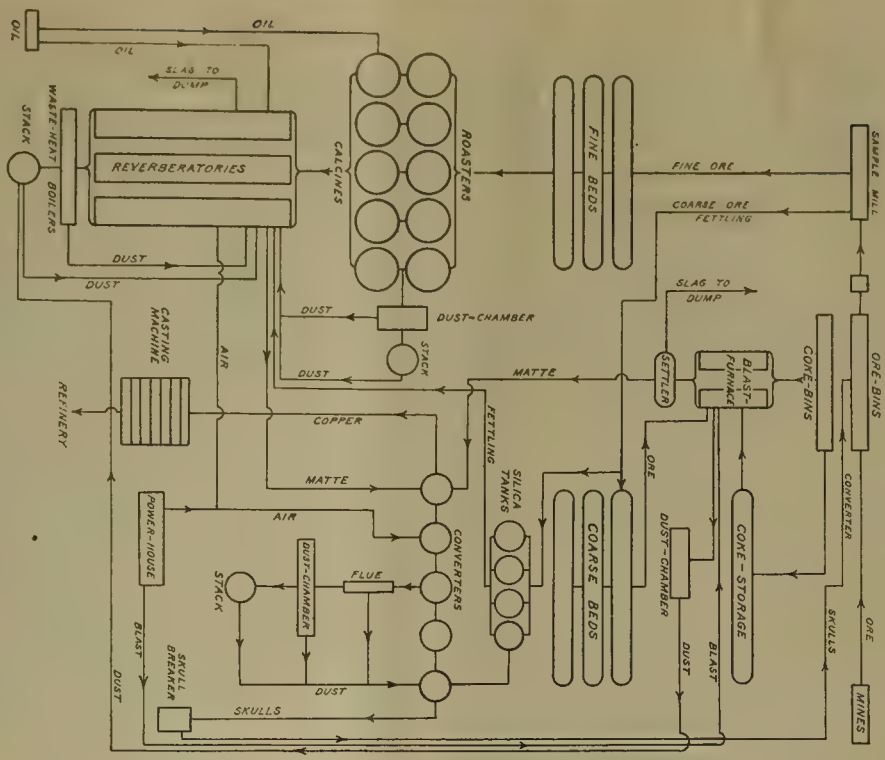
The official figures regarding the blast-furnaces are also given. As previously stated, there are two furnaces of the long pattern first developed in practice by E. P. Matthewson, though it had long been pointed out by metallurgists that there was no necessary limit to the length of a rectangular furnace for copper smelting. At the Calumet & Arizona plant they are 40 ft. long by 48 in. wide at the tuyeres. There are 64 tuyeres, 4½ in. diam., and the elevation from the tuyere-line to the feed-floor is 16 ft. 4½ in. Exclusive of coke, the charge fed per furnace amounts to 996 tons per day, requiring 44,169 cu. ft. of free air per minute, equivalent to 68,645 cu. ft. per dry ton, the blast being supplied at a pressure of 27 oz. The coke used is 12.7% and the dry tons of ore on the charge amounts to 89.7%. The flue-dust produced is 3.4% of the total dry charge. The accompanying full-page drawing gives the details of construction of these big furnaces, showing exterior and interior fittings, fire-hearth, matte-launder to converter-ladle, and, on the opposite side the high-level slag-discharge from the fore-hearth, and the position of the slag-pot. It is a model of excellent design.

Analyses of Blast-Furnace Products

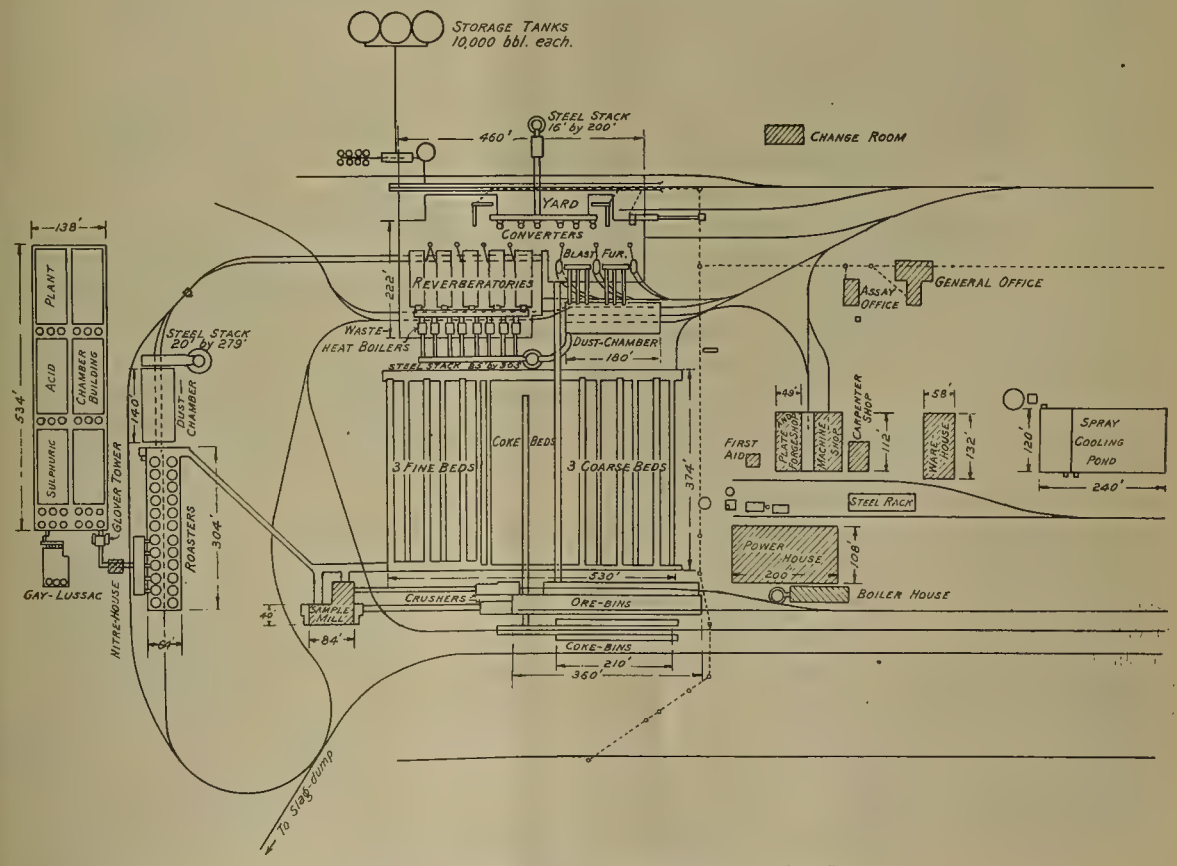
	Charge average. %	Slag average. %	Matte average. %	Flue-dust average. %
Silica	22.2	35.3	...	20.9
Alumina	5.3	9.4	...	8.0
Iron (Fe)	25.9	...	40.0	28.6
Iron (FeO)	...	37.8	...	...
Lime (CaO)	5.9	9.0	...	2.4
Sulphur	13.1	...	25.3	9.1
Copper	5.29	0.41	28.81	5.0
Zinc oxide	...	...	...	...
Manganese oxide (MnO)	...	...	...	...
Magnesia (MgO)	...	...	...	...

Another drawing shows in detail the construction of the reverberatory furnaces, which likewise are examples of the best modern practice. There are four of these, all being 100 ft. long, and 19 ft. wide. It will be seen that the furnace is erected upon a deep foundation of poured slag. On this comes a 4-in. layer of tamped fire-clay, followed by 12 in. of crushed quartz under the matte-bay, and 21 in. under the remainder of the furnace-hearth, the matte-bay being 20 ft. long. The 21-in. I-beams, to take up the thrust at the rear of the furnace, are anchored securely by 2-in. rods with 10-in. plates at the end, laid in the poured slag. The expansion-joints, which are three in number, and are spaced about 18 ft. centre to centre, are breaks in the arch 7 in. wide at the key-line, and tapering to a fraction of an inch at the walls. There are 42 fettle-holes on each side. 6 by 6 inches in size, and spaced 2 ft. apart from centre

[1] M. & S. P., March 30, 1918.



FLOW-DIAGRAM OF CALUMET & ARIZONA SMELTER



PLAN OF CALUMET & ARIZONA SMELTER AND YARDS

to centre, open through the arch close to the inner wall. The advantages of fettle-feeding, with details, have already been discussed in connection with the smelting practice at the plant of the Kansas City Smelting & Refining Co., at El Paso, in the MINING AND SCIENTIFIC PRESS of May 25, 1918. The protection given to the walls is better than when fettling is employed in the old way, and the limits of the bath are more flexible. Thus a better adjustment to smelting conditions is possible than when the bath is held to rigid lines.

The matte-bay is an interesting detail, especially with regard to the expansion of the bath when side-charging is employed. It hints at conditions not unlike those that would obtain by the enclosure of what is essentially a fore-hearth within the reverberatory itself. This has been the subject of direct experiment elsewhere. The outcome of those experiments will be watched with interest. The object is to grade the matte, and to permit of a continuous discharge of slag, from which the matte may be settled more perfectly than under the old system. One problem, however, is the invariability of the arch-temperature. Periodic cooling, at the times of slag-skimming and of charging, tend to prolong the life of the arch. Indeed, in side-charging much of that advantage is sacrificed, and even the feed generally contributes heat since the custom prevails, at most plants where side-charging is practised, of bringing the calcine from the roasting-furnaces to the reverberatories as hot as possible. The idea of including the settler within the furnace suggests the probability of greater fuel-economy. It must be understood that the reference here is merely to the tendency of the bath to widen, forming a conspicuous embayment, as was explained more fully in discussing the reverberatory practice at the El Paso smelter. At Great Falls a fore-hearth is applied to the reverberatory, placed outside as is done at blast-furnaces; this gives nearly the same advantage in restricting heat-losses. With side-charging a much more uniform state of the bath can be maintained, as there is no periodic disturbance from drawing down and adding charges of fresh ore. Side-charging naturally suggests taking fuller advantage of the possibility of uninterrupted smelting, and that leads to a consideration of the benefits that may accrue from a continuous discharge of the products of fusion. There is probably no great difference between the total heat-loss in the two methods. It will be interesting, when sufficient definite figures from a number of plants become available for the purpose, to work out the balance of cost between the two systems, taking into account the smelting capacity per campaign, giving proper credit for the larger heat recovery per unit of copper produced by side-charging. At the Calumet & Arizona the charge going to the reverberatories is cold, consisting of silicious ores. As the reverberatories are now operated at this plant high-sulphur ore is used as a cleaner preparatory to skimming. It has been proposed by some metallurgists to employ super-heating at the slag-end of the furnace before skimming, for which purpose auxiliary burners on the side would be requisite.

At the time of my visit each of the furnaces in the plant was treating 400 tons per day, exclusive of converter-slag, but recent changes have increased this to 700 tons. At El Paso also the smelting capacity was greatly augmented without altering the structural details of the furnace. This increase in smelting capacity is the result of a more perfect combustion of the fuel-oil close to the firing-end, which in turn limits the smelting-zone to approximately the same limits. The charging accordingly is not carried so far toward the front of the furnace, leaving the remainder of the hearth to constitute a pool in which the matte separates more perfectly from the slag. The distribution of heat under this system is as satisfactory as under the old system where a longer flame was used, and the more perfect combustion results in securing the requisite heat with a reduced quantity of fuel. The advantage is conspicuous when firing is done with oil, but it appears to be even greater when powdered coal is employed.

The converter-slag returned to the reverberatories, at the Calumet & Arizona plant, averages about 500 tons per day; it is poured into the furnaces in a molten condition and assays about 3.25% copper.

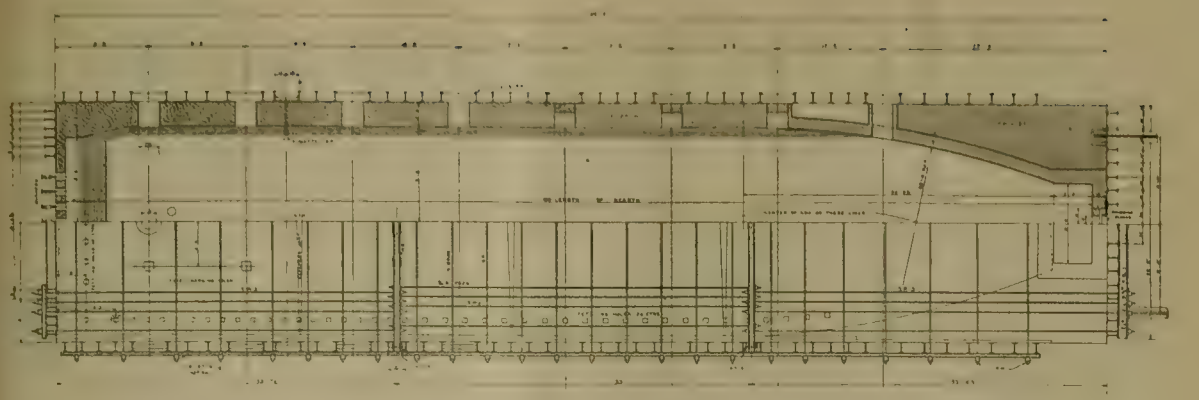
The copper in the reverberatory charge is from 5.16 to 5.40%. The following analyses of the products are characteristic:

Reverberatory Products

	Solid charge		Slag, including converter slag		Matte	
	1	2	1	2	1	2
	%	%	%	%	%	%
Silica	28.3	28.0	34.6	34.7	...	0.8
Alumina	4.1	4.0	6.0	5.8	...	...
Iron (Fe)	29.3	28.8	...	...	41.2	41.2
Iron (FeO)	...	...	47.5	47.9	...	...
Lime (CaO)	3.0	3.0	3.7	3.8	...	...
Sulphur	8.5	8.8	...	...	26.1	25.7
Copper	5.16	5.4	0.39	0.40	25.03	25.3
Zinc oxide	...	...	...	1.4	...	...
Manganese oxide (MnO)	...	...	...	1.4	...	...
Magnesia (MgO)	...	...	...	1.3	...	...

The official statement of the company gives the consumption of fuel-oil per ton of total charge as 0.752 bbl. Steam recovered from the waste-heat returns a credit to the reverberatory of 0.298 bbl. per ton of charge, leaving 0.454 chargeable exclusively to smelting. These figures have been reduced to an average of 0.719 bbl. of oil burned per ton of total charge; a steam-credit of 0.303, and a net consumption, chargeable against the ore smelted, of 0.416 bbl. A Californian asphalt-base oil, of 23° Baumé, having a heating value of 19,000 B.t.u., is used. The elimination of sulphur from the charge by volatilization during smelting is about 27% of the total in the ore fed. The reverberatories and the blast-furnaces are at the opposite ends of the same structure, and are parallel to the converter building, so that the matte from both is delivered into ladles within the adjacent converter-plant, and within reach of the cranes.

There are six converter-stands, mounting 12-ft. basic-lined converters of the Great Falls type. Two extra shells are kept on hand to facilitate repairs. The silica is fed into the converters through pipes leading from overhead bins. The matte is blown to blister containing on an average 99.15% copper. It is cast into ingots of 300 lb. each, being poured from 160 cu. ft. cast-steel ladles into



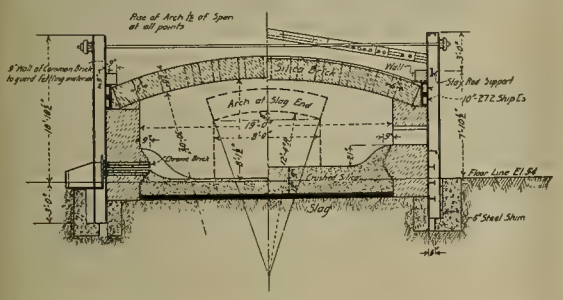
CALUMET & ARIZONA 19 BY 100-FT. REVERBERATORY FURNACE; ONE-HALF PLAN-SECTION

molds in a straight-line casting machine. The ingots are shipped to the Nichols Copper Co. at Laurel Hill, New York. The converter-scrap is handled back to the converters, with the exception of the skulls. These are broken in a McGregor skull-breaker, and are then sent to the blast-furnace beds. The amount of broken skulls is about 150 tons per day, and assays 10% copper. The company's published statement of converter products gives the following analyses as typical:

Converter Products

	Silicious flux, %	Converter slag, %	Bullion, %
Silica	72.7	16.7	...
Alumina	5.4	2.1	...
Iron (Fe)	5.8	...	...
Iron (FeO)	...	70.6	...
Lime (CaO)	0.1	...	...
Sulphur	2.9	...	...
Copper	4.58	2.79	99.16

The roaster stack is separate from all others. It is 20 ft. diam. and 279 ft. high. The dust recovered in the roaster dust-chamber amounts to 22 tons daily and con-



CROSS-SECTION, CALUMET & ARIZONA REVERBERATORY

tains about 5.6% copper, 0.3% lead, 3.3% zinc, 3 oz. silver, and 0.06 oz. gold per ton. From the dust-chamber in the flow-line of the acid-plant two tons per day of a similar product are collected. The converter gases, amounting to 240,000 cu. ft. per minute, show a moderate stack-loss in dust containing approximately 15% copper, 34% lead, 9.5% zinc, with 11.5 oz. silver and 0.086 oz. gold per ton. It is probable that a Cottrell treater will be installed to recover this dust. The general superintendent of the Calumet & Arizona smelter is H. A. Clark, and the metallurgist in charge of smelting operations is Carl H. Cole.

WOLFRAM ore is being mined in the districts of Haifeng, Lufeng, P'u-ning, Kityang, and Wuhua, China, according to a Consular Report. At first it was found in small quantities on the surface, but recently its existence in vein deposits has been proved. The Wuhua district (old name Changlok) appears to contain the largest deposits. A group of villages about Tung-ling-hsia, among which are Chiu-lung and Ho-tung, is the principal centre of production. This area is said to cover 6 or 7 square miles, and it is here that the ore is found in large veins, being associated with quartz crystals. It is claimed that over 2000 booths have been erected as shelter for the people who have flocked there in search of 'black gold,' as it is called by the natives. This area is 50 miles north from Hopo, the head of small-craft navigation in the Kityang river. Other centres of production are Hei-lin in the Wuhua district and Tai-yong in the Kityang district. A large market for wolfram is Waichow, and there is little doubt that much of the ore mined in this district reaches that place. With the development of the Wuhua and Kityang districts, Swatow's importance as a market increases, as it is the natural port of these districts.

MAGNESIUM as a fertilizer is described by F. Masino in the 'Giorn. Farm. Chim.' No. 65, 1916. Comparing the growth of two lots of wheat, the same number of seeds being sown in each case, one plot being watered with a 5 : 1000 $MgSO_4$ solution, and ordinary water being used for the other, the soil that received the $MgSO_4$ solution remained more moist than the one receiving the ordinary water; the plants of the lot watered with $MgSO_4$ solution were also higher, stockier, and more vigorous than those of the second lot and bore a larger number of matured seed-heads. Ordinary vetch gave the same results. The use of magnesium increased the amount of chlorophyll, which in turn resulted in an increased growth of plant-tissues and the synthesis of organic compounds necessary for plant life.

The Menace to Gold Mining

The following statement was prepared by Charles G. Yale, for the California Metal Producers Association, on July 16, as a memorandum for the use of Raymond T. Baker, Director of the U. S. Mint.

What the gold miners of California strongly desire is co-ordination of the different Federal departments, with relation to the mining of gold during the War. They wish this gold-mining industry to be officially declared an essential one so that these departments may work together. Under the present circumstances it is virtually considered non-essential, which has resulted in unfortunate conditions.

The uncertainty of the attitude of the Government regarding gold mining is a factor causing much unrest at the present time; with fixed conditions, renewed efforts to keep the mines productive would be put in force. The absolute determination of this point is necessary. If these gold mines were compelled to close down, as appears likely under present conditions, they could not be brought up to full productive force within five years, which would reduce gold stocks of domestic production fully fifty million dollars during that period in California alone.

The present conditions of the unusual decadence of gold mining in California started when the Californian electric and water-power companies recommended to the State Railroad Commission a priority list placing quartz-gold mining and dredge mining No. 38 and 39 in a list of 45. Yet it was admitted by the power companies that the maximum station demand was 15,000 hp. for gold dredging, and 9000 hp. for quartz mines. This matter has not yet been determined, but is of public notoriety, badly damaging the gold-mining interests.

The next detrimental step was when the general classification list of the Priorities Board was issued as to steel commodities and hardware when gold mining was ignored as essential. The larger hardware companies of the State, in their business notices to their traveling men, issued the following: "Mining companies are also included with the exception of gold mines, which we understand at the present time are classed as non-essential, although we believe there will be a revision of this classification later."

The result of this statement, passed about in the mining centres of the State, was to lead miners to conclude that gold mining might be ultimately closed down, so that numbers of them left for employment in more stable industries.

Moreover, it was found difficult to get in ordinary supplies for mining purposes, and steel, iron, and hardware have been especially hard to procure by the miners in the interior of the State. In one case a very large company had to wait four months for necessary steel cable for the cages in its shaft. The gold-dredges, which use large quantities of steel rope, are constantly placed under difficulties in this respect.

The War Industries Board has been appealed to several times for relief in this matter of priorities, but thus far no answer has been received from the letters.

Secretary of the Treasury McAdoo in a letter to representative Sulzer of Alaska, published in the Congressional Record of June 15, 1918, said: "I would be sorry if there were any relaxation in the effort to produce gold. At no time has the country so much required the largest possible production of gold as at present. Next to food and ammunition, gold is one of the most needed war essentials. The maintenance of gold production at the maximum point is a great necessity. The man or community that maintains or increases its production of gold in the face of difficulties and discouragement is performing a patriotic service."

Notwithstanding this direct statement there is no declaration of the Priorities Board or War Industries Board that gold mining is an essential industry.

Meantime, moreover, the Engineers' branch of the U. S. War Department is insisting on quartz miners erecting and maintaining permanent and very expensive impounding works to prevent any tailing passing into even the smallest tributaries of navigable streams. This is an additional burden, only imposed after some 65 years of mining in California, which might well be deferred until a year or more after expensive conditions at present existing.

The gold-mining industry is at present in a state of temporary decadence in California. This is due to causes having nothing whatever to do with the actual mines themselves. Numbers of gold miners have gone into the Army or Navy, and thousands of others into the working of commercial minerals, while many more have gone to work in industrial occupations, such as shipbuilding, where the emoluments are greater.

The deep or quartz mines are most materially affected, their gold output annually having fallen off 15 to 20%. The cost of skilled labor, supplies, etc., have materially increased and the purchasing power of the gold produced is much less than formerly. A great curtailment of gold-mining operations will result unless some remedy is provided.

Numerous gold mines in the State of California have been compelled to close down under present circumstances and more are following. The cost of producing an ounce of gold has increased from 50 to 75% within a year. Gold is not to be classed with utilitarian metals of commerce because it serves exclusively as the standard for monetary purposes. The Government bonds depend for their standing on our gold reserves and these should be added to from our own mines as rapidly as possible. If our gold mines are compelled to close down these reserves must be decreased.

California has been for 70 years, with a very few annual exceptions, the leading gold-producing State of the Union. Its gross output has been $1,672,681,000 to the end of 1917, which is far ahead of any other State, or group of States. It still produces over $20,000,000 a year in gold alone. Surely an industry with such an exceptional record should receive every encouragement from the Government.

Minerals Separation and Beer-Sondheimer

A CHRONOLOGY

December 30, 1903: The company known as Minerals Separation, Ltd., is registered at Somerset House, in London.

August 24, 1910: A company—also British—called Minerals Separation American Syndicate, Ltd., is registered in London to take a two-year option from Minerals Separation, Ltd.

October 10, 1910: M. S. Ltd. and M. S. A. S. Ltd. agree to organize a new corporation to acquire the patent-rights belonging to M. S. Ltd.

June 26, 1913: Accordingly, Minerals Separation American Syndicate (1913), Ltd. is organized under British law.

September 10, 1913: M. S. A. S. (1913), Ltd. agrees with the firm of Beer, Sondheimer & Co., of Frankfurt-am-Main, Germany, to appoint B. S. & Co. sole agents for M. S. A. S. (1913), Ltd. in order to exploit its patent-rights in North America. This agreement appears not to have been filed at Somerset House.

August 4, 1914: Declaration of war by Great Britain against Germany, rendering void all contracts between citizens of the two belligerent countries and therefore breaking the agency between the British company, M. S. A. S. (1913), Ltd., and the German firm of B. S. & Co. Despite this legal fact M. S. A. S. (1913), Ltd. tries as far as it can, through the New York agents of B. S. & Co., to continue its agency business in America.

August 4, 1914: Otto Frohnknecht, one of the New York agents of B. S. & Co., declares his intention to become a citizen of the United States.

October 5, 1914: Otto Frohnknecht and Benno Elkan, agents in New York for B. S. & Co., declare that they have not paid, and will not pay, to B. S. & Co. during the War any part of the commissions accruing under the agreement of 1913 between M. S. A. S. (1913), Ltd. and B. S. & Co. This agreement also was not filed at Somerset House, but it is mentioned in a later agreement, of August 4, 1916, which was filed, as British law requires, on November 3, 1916.

January 6, 1915: M. S. A. S. (1913), Ltd. appoints Benno Elkan and Otto Frohnknecht "doing business as B. S. & Co., American branch," to be its sole agents in North America.

February 15, 1915: Benno Elkan declares his intention to become a citizen of the United States.

April 5, 1915: Harry Falck, another of the New York agents of the German firm of B. S. & Co., testifies that B. S. & Co. continues to collect royalties in North America in behalf of M. S. A. S. (1913), Ltd.

August 26, 1915: Otto Frohnknecht, Benno Elkan, and Harry Falck organize the firm of Beer, Sondheimer & Company, Inc. under the laws of New York state.

July 18, 1916: The New York branch of B. S. & Co. and the New York corporation of B. S. & Co. Inc. are placed on the British black-list. Despite this action of the British government, M. S. A. S. (1913), Ltd. endeavors to help Otto Frohnknecht and Benno Elkan by making a new agreement, replacing (1) that of September 10, 1913, between M. S. A. S. (1913), Ltd. and the German firm at Frankfort, this agreement having been nullified by the outbreak of war, and (2) the later agreement, of January 6, 1915, between M. S. A. S. (1913), Ltd. and the New York agents (Otto Frohnknecht and Benno Elkan) of B. S. & Co., this agreement being now nullified by the British black-list. Accordingly on

August 4, 1916: M. S. A. S. (1913), Ltd. and John Ballot, as purchasing trustee, make another agreement with Otto Frohnknecht and Benno Elkan "doing business as B. S. & Co., American branch at No. 61 Broadway in the City of New York." By this agreement the trustee, John Ballot, purchases everything owned by M. S. A. S. (1913), Ltd. and agrees to transfer it to a new corporation. At the same time the agency agreement, now nullified, of 1915 is modified so that Frohnknecht and Elkan become "general agents" for the new corporation, which, instead of paying them commissions is to issue stock to be held in trust by the Guaranty Trust Co. of New York, so that no benefits therefrom shall accrue to Frohnknecht and Elkan until the end of the War. By this it becomes possible for the new American corporation to deal with the two agents of B. S. & Co. without conflicting with the British black-list.

October 6, 1916: The above agreement is ratified by M. S. A. S. (1913), Ltd.

December 9, 1916: The new company, Minerals Separation North American Corporation, is organized under the laws of Maryland, in accord with the agreement of August 4, 1916.

January 1917: M. S. N. A. Corp. under its letter-head carries the following names: "General Agents, Beer, Sondheimer & Company, 61 Broadway, New York, Cable: 'Beersond'." This has been the office and cable address of the New York branch of the German firm of B. S. & Co.

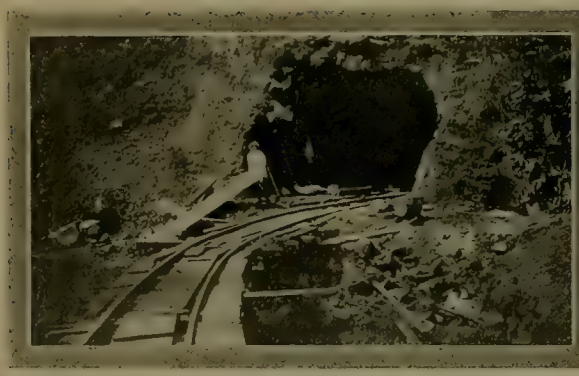
February 6, 1917: Otto Frohnknecht is admitted to American citizenship.

March 16, 1917: M. S. A. S. (1913), Ltd. goes into liquidation and ceases to exist.

April 6, 1917: The United States declares war on Germany.

May 22, 1917: Benno Elkan is admitted to American citizenship.

July 22, 1918: The property of Beer, Sondheimer & Co. is seized by the Alien Property Custodian. Among the assets is a block of 30,000 shares of Minerals Separation American Syndicate, Ltd.



NORTH PORTAL BEFORE PLACING MACHINERY

VICINITY OF SOUTH PORTAL

The 7000-Foot Tunnel at Lahaina, Hawaii

By Fr. KOELLING

On the south-western side of the island of Maui, second in size of the Hawaiian group, are situated the properties of the Pioneer Mill Co., Ltd., comprising some 28,000 acres. Of this area, 9500 acres is applied to the cultivation of sugar-cane, the principal industry of the islands. Owing to the low average rainfall over the lower cultivated area at Lahaina, an extensive irrigation system is maintained. To give an adequate idea of the enormous amount of water required for a plantation of the extent of Pioneer, it is only necessary to state that between 85,000,000 and 100,000,000 gallons of water is used daily, of which quantity 40% is furnished by high-lift pumps. Water is lifted by the pumps from wells at sea-level to an average head of 260 ft. The remaining 60% is supplied by mountain streams and tunnels, the latter forming the subject matter of this article. In the mountains back of Pioneer is situated the beautiful Honokowai gulch, one of the grandest and most picturesque to be found on Maui. Far back in the narrowest part of the gulch, under heavily forested and almost perpendicular cliffs that tower above it some 1000 ft., is situated the north portal of the 7000-ft. Honokowai tunnel which is being constructed to replace a semi-circular galvanized-iron flume that has been used since 1898. Although parts of this flume are still in fairly good condition and would have lasted for several years more, the redwood trestles had deteriorated to such an extent that the Pioneer Mill Co. concluded to abandon it altogether. The tunnel will not only have the advantage of permanency, but will also have ten times the present capacity of the flume.

The tunnel, which is situated at an elevation of 1525 ft., is of horse-shoe section, 6 by 6 ft. inside of concrete lining, and is designed for a capacity of 50,000,000 gal. daily. Power for the tunnel is furnished by hydro-electric stations, operated in synchronism, having a total capacity of 2000 kva. The nearest station is at an elevation of 940 ft., 11,000 ft. distant from the north portal and 8500 ft. from the south portal, as measured along the transmission-lines. The transmission-line consists of three No. 6 galvanized iron wires (later to be used for fence purposes) strung on proper insulators of temporary construction, carrying 6600 volts, which is stepped down to 440 at the portals. The longest span is 700 ft., across a gulch on the south-portal line. This line branches from the north-portal line 4000 ft. from the power-house, and this latter section carries 250 kva.; 40 kva. for the blacksmith-shop there, 120 kva. for the north portal, and 90 kva. for the south portal. This station derives its power from the Honokowai stream and from water developed from mountain tunnels, and on completion of the tunnel will be enlarged and moved to a new place.

OLD FLUME IN HONOKOWAI GULCH

The machinery for the north heading consists of one 10 by 10-in. Laidlaw-Dunn-Gordon compressor with 50-hp. motor, one 8 by 8-in. Ingersoll-Rand compressor with 35-hp. motor, one size 5 type B American blower, with 15-hp. motor, one Allis-Chalmers motor-generator set of 12½ kw., one 3½ by 10½ ft. air-receiver, one three-

ton Jeffrey locomotive with Edison battery, cars, rails, pipe, lumber, transformers, etc. This was all hauled by Holt caterpillar traction engines to an elevation of 2500 ft., directly above the north portal. At this point, an A frame with sheaves, 'dead-men', etc., was erected and a ⅝-in. steel cable run to the opposite side of the gulch and anchored to a number of large trees, 300 ft. above the bottom of the gulch and opposite the portal. The cable was drawn taut by the 45-hp. caterpillar engine traveling down the mountain road, after which the load was hung on two sheaves running on the cable and slacked down by a 3-in. manila rope until it was directly above the bottom of the gulch, when both cable and rope were slacked together and the load landed at the portal. The heaviest load weighed 2¼ tons.

The south portal is in a gulch, and a 12-ft. road, 1500

LOWERING AIR-RECEIVER FOR COMPRESSOR, SHOWING PRECIPITOUS CHARACTER OF COUNTRY

ft. long, was constructed along its side on the grade of the distribution ditch which will later take its place. The machinery for this end was hauled by Holt caterpillars directly to the portal. It consists of one 16 by 14-in. and 10 by 14-in. duplex, Imperial type 10, Ingersoll-Rand compressor with 100-hp. motor direct connected, one 12½-kw. Allis-Chalmers motor-generator set, two No. 4 Sturtevant blowers with 3-hp. motors, one 4 by 6 by 8-in. duplex Worthington pump, and one Jeffrey electric locomotive, transformers, etc. A blacksmith-shop situated at the main camp half-way between the two portals is equipped with one 8 by 8-in. Laidlaw-Dunn-Gordon compressor, 20-hp. motor, No. 635 Leyner sharpener, forge, drill-press, emery wheels, etc. The steel is sharpened with a four and five-point regulation Leyner die and plunged for tempering.

In the north heading, two No. 18 Leyner drills and four sets of 1¼-in. hollow steel from 24 to 96 in. are used, one machine drilling 6 ft. per hour and averaging 1150 cu. ft. of free air at 80 lb. pressure per lineal foot of hole drilled. The water for the drills and compressor is taken from the stream at an elevation far enough above the portal to give 45 lb. pressure. The air-line is 2 in., and the water-line 1 in. galvanized-iron pipe. In the south heading, two No. 9 Leyner drills and four sets of 1⅜-in. hollow steel from 24 to 96 in. are used. The pressure maintained at the compressor is 90 lb. per sq. in., and there is a large surplus of air. The water for the drills is forced into the tunnel and compressor by a 4-in. Worthington duplex pump, regulated to 40 lb. pressure and operated by air. Three shifts of two drillers, two helpers, three shovelers, and a shift-boss are employed. A 7-ft. round of from 10 to 16 holes is drilled in 7 hours, one hour being taken up in setting-up a bar twice, loading holes, etc. The drills are mounted on horizontal bars; several shoveling-sheets 5 by 5 ft., stone picks, and square-pointed shovels are used. The ventilation in the north heading is supplied through an 8-in. pipe from the blower making 2400 r.p.m., under a pressure of 2 lb. per sq. in. At the south heading 16-in. pipe is used, the blowers making 1800 r.p.m. under very low pressure. Immediately after blasting the blowers exhaust for 20 minutes and thereafter force fresh air continually into the tunnel. Underground currents of air have been encountered, at times sufficient to extinguish a candle when applied to the vent. This aids ventilation somewhat. For illumination, 50 and 75-watt, 110-volt Mazda lamps are used. The main camp, power-house, and both portals are connected by telephone, which can be connected to the plantation system when necessary.

The rock penetrated is of volcanic origin, consisting of two main varieties: (1) Trap rock, a hard, blue, flinty rock, in dikes of from 2 ft. to 100 ft. in width. And (2) water rock, a hard porous rock, containing many olivines and a burnt, crumbly, formation interspersed. In drilling this porous rock, much time is lost in extracting the larger drills on account of its crumbly nature. This tends to pack around the drill causing it to stick in the hole. It is often necessary to 'shoot' a drill, and when loading, the holes become 'dogged' with small rocks. In driving a similar tunnel on the island of Oahu, 750-ft. elevation, water was encountered after each vertical dike had been drilled through on the windward side of the island, until about 2000 ft. past the middle of the range. No water has been encountered in the Honokowai tunnel. This may be explained by its being on the leeward side of the island, the water draining to the windward and more precipitous side. Gelatine powder, 40%, triple-tape fuse, and No. 6 caps are used. Fifty pounds of powder breaks about 4½ ft. The only timbering necessary was between station 16+30 and 17+00 in the north heading where a cave-in took place, caused by the loose nature of the rock. The waste is transported in side-dump, 1-yd.

Koppel cars, and hauled by a three-ton Jeffrey electric locomotive. The track is 24-in. gauge.

The machine-drills were started in the north heading on August 5, 1917, and in the south heading on October 7, 1917, 950 ft. having been driven by hand. The two headings were brought together on March 30, 1918, 3802 ft. from the north end and 3198 ft. from the south end; the centre line was out 6 in., the grade and distance being correct.

The actual time of excavation was 10 months. Had all the equipment been in operation from the start, the tunnel could have been excavated in 7 months. The maximum monthly progress was made in December, 1054 ft. being driven in 28 days, or an average of 37.64 ft. per day. The cost per foot for the excavation has been approximately $11, and the cost of lining the tunnel is estimated at $2, which will bring the cost of the main tunnel to $13 per foot. Two feet of the sides and floor of the tunnel are now being concreted, the aggregate being taken from the dump. A small crushing plant with sand rolls, etc., has been erected at the south adit. Two mixers operated by gasoline are in use. In connection with this tunnel, a feeder tunnel of 25,000,000-gal. capacity, 813 ft. long, and three lateral tunnels of 35,000,000 gal. capacity, 1152 ft. long, have been completed. Two intakes are in course of construction, and a concrete flume at the south portal, 2700 ft. of supply ditch, pipeline, and storage reservoir remain to be built.

Calculating Percentage of Recovery in Concentration

By ARTHUR H. P. MOLINE

*In small mills it is usually inconvenient and often impossible to weigh all the material treated and products obtained. Where the weight of concentrate in any process is so small as to be negligible in comparison with the weights of feed and of tailing, it is then a simple matter to obtain the weight of feed from the assay-values and the weight of the concentrates. Call the assay-value of the feed and tailing respectively F and T, and the weight of concentrate C, then $\frac{C}{F-T}$ = weight of feed, and the percentage recovery = $F\text{-}T/F \times 100$. F, T, and C may be given in any suitable units provided they are all the same. For example, in cyanide work, F and T may be expressed in grains per ton, and C in grains. Then the equations given above hold. Where the weight of the concentrate produced is an appreciable proportion of the total weight treated, as in lead or zinc concentration, the problem is not so simple, and the following method is suggested. It is assumed that the following data are available: Assay-value of feed; assay-value of tailing; assay-value and total weight of concentrate produced.

Let F = weight of lead in feed, unknown.
f = weight of gangue in feed, "
T = weight of lead in tailing, unknown.
t = weight of gangue in tailing, "
C = weight of lead in concentrate, known
c = weight of gangue in concentrate, "

Gangue includes everything that is not lead. Assay-values of feed and tailing are known, so that the ratios f/F and t/T are known. Call f/F K and t/T n; then $f = KF$, and $t = nT$. It is obvious that:

$$F = T + C \quad (1) \text{ lead equation}$$
$$f = t + c \quad (2) \text{ gangue equation}$$

In equation (2), substitute for f and t the values KF and nT, respectively. Thus we have:

$$KF = nT + c \quad (3)$$

and multiply equation (1) throughout by n, giving

$$nF = nT + nC \quad (4)$$

Subtracting (3) from (4) we eliminate T and obtain

$$(n-K)\ F = nC - c$$

$$\text{therefore } F = \frac{nC - c}{n - K} .$$

giving the value of F in quantities all of which are known, and then

$f = KF$
$F + f$ = total weight of feed (dry)
$C/F \times 100$ = percentage recovery

The accuracy of the method depends, of course, upon the accuracy of the sampling, and unless this can be relied upon, the result may be misleading. It may be pointed out that the higher the percentage recovery, the less liability there is to error. F is inversely proportional to $n-K$, and if the recovery is low the values of n and K will contain all the errors due to the sampling and assaying of the feed and tailing. Those errors may be compensated to some extent, but this cannot be relied upon. The greater the difference between the values of n and K, the less will be the effect of errors in sampling and assaying on the result of the calculation. The method is applicable obviously where two products only additional data are required in order to solve the problem.

*Abstract: 'Chemical Engineering and Mining Review.'

ALUMINUM of good grade containing over 99% aluminum, when poured at 1000° C., shows slightly less ultimate strength than when poured at 750°; this would indicate that overheating is not as serious as has been claimed. Occasionally aluminum castings are found to be pitted with small surface holes and the body of the metal may be contaminated with Al_2O_3; there is then no remedy but to scrap and re-melt. When magnesium, sulphur, $ZnCl_2$, or $Na_2B_4O_7 + KHSO_4$, were used, no favorable effect is noticed.

ORTHOCLASE varies in potash content from 6 to 15%. It is rare to find a dike of orthoclase, however, containing above 8%. High-grade orthoclase is in some demand in the fictile art, and under exceptional circumstances, such as nearness to cheap transportation and a cheap supply of common salt and fuel, together with proximity to market, it might serve as a source of potash.

Standard Method for Zinc-Lead Assay

By W. GEORGE WARING

As a result of the efforts made in the Joplin district to standardize the methods for determining lead and zinc in ores and concentrates, a committee, constituted of the chemists and assayers connected with the industry, collected information regarding nine different schemes of analysis, and reached the conclusion that fairly accordant results are shown in assays made by the colorimetric, gravimetric, and iodide methods. No reports were submitted as to the oxalate-permanganate, or the electrolytic-lead-dioxide methods, which are recognized as possessing a high degree of accuracy. The electrolytic was not considered suitable to the conditions in the Joplin district, and the colorimetric requires a special equipment that excludes it from being considered. The gravimetric method is thoroughly reliable, but requires much skill in manipulation. The chromate method, in its several modifications, gave fair results, while the molybdate method proved unreliable as tested on three samples. The committee fully realized the convenience and rapidity of the 'direct chromate' method, but owing to the necessity for establishing without delay a standard procedure that should be above suspision the sulphate-chromate method, as given herewith, was recommended.

Use 3 or more grammes of ore as the sample for analysis. Decompose with not less than 4 cc. HNO_3 and 2 cc. of H_2SO_4 for each gramme of ore taken. Boil rapidly to heavy SO_3 fumes in a covered casserole or beaker. Cool sufficiently. Wash down and disintegrate the cake with 15 cc. of 'lead acid' (see below) per gramme of ore, avoiding any loss. Add about 0.5 gm. cryst. sodium sulphate, or 0.25 gm. of the dry salt, and boil for a minute after the cake is all dissolved with the exception of the insoluble portion. Cool thoroughly and allow to stand undisturbed for half an hour. Filter through Whatman No. 5, 40 or 42 filter, by decantation at first, returning the first filtrate to the filter before washing. Wash the residue into a filter with 'lead acid' from a wash-bottle, thoroughly rinsing the casserole or beaker with 'lead acid,' and wash the residue or filter with 'lead acid' three times; then instead of washing the 'lead acid' out of the casserole or beaker and out of the residue with 50% alcohol, use pure water containing 1 cc. of strong H_2SO_4 to the litre, repeating this washing once. Be sure to wash the filter-paper from the top down. Those who are equipped with the proper facilities for color comparison can proceed from this point for the colorimetric tests. The use of a few drops of dilute gum arabic solution (about 1%) to the lead acetate solution before adding alkaline sulphide is recommended.

Next dissolve the $PbSO_4$ in the residue, and filter in hot ammonium acetate, washing through the filter with acetate solution until a drop of the filtrate washing no longer darkens a drop of Na_2S. Dilute the filtrate and washings, if necessary, to a volume of about 200 cc., make weakly acid, if not already so, with acetic acid. Heat to boiling and add a normal or nearly saturated solution of potassium bichromate in distinct excess, boil five minutes to make the precipitate crystalline and easier to wash. Keep this mixture very near the boiling temperature on a hot plate for 30 minutes, then filter through a close filter, the same kind as that used for the $PbSO_4$ residue, and wash out the excess of $K_2Cr_2O_7$ thoroughly with hot water. Then treat the filter paper and the precipitate in a suitable beaker with 10 cc. of 20% NaOH solution, stirring to effect complete solution; acidify with 30 cc. of 1 to 4 H_2SO_4, dilute to 100 or 200 cc., add with a volume-pipette 10 cc., 20 cc., or such measured amount of standardized ferrous ammonium sulphate solution as will leave a moderate excess of ferrous iron, and titrate that excess with standard permanganate. The value in terms of standard permanganate of the total ferrous solution added, less the permanganate required for the reverse titration, when multiplied by the lead value of the permanganate referred to chromate of lead gives the amount of lead.

The effective standard solution is the permanganate. Whatever convenient standard is used in the laboratory for the iron titrations will serve for the lead chromate. The ferrous ammonium sulphate solution may be made to correspond as nearly as possible with the permanganate. If 1 cc. of permanganate = 0.0005 gm. Fe, then 35.11 gm. of pure ferrous ammonium sulphate dissolved with 10 cc. concentrated H_2SO_4 in water to make one litre will give a solution of corresponding strength. A small piece of pure aluminum should be kept in the solution to maintain the iron in the ferrous state. The value of the solution in terms of the standard permanganate must be known at all times.

The reaction of lead chromate with ferrous sulphate being $2(PbCrO_4 + 8H_2SO_4 + 6FeSO_4 = 3Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + 2PbSO_4 + 8H_2O$, 6 parts of ferrous iron corresponds to 2 parts of Pb, or 1 part ferrous iron = $\frac{207.2}{167.52} = 1.2368$ parts Pb, and 1 cc. of the standard permanganate will correspond to 5×1.2368 or 6.184 mg. Pb, or in round numbers 6.2 mg. If then 6.2 gm. of ore be taken for the assay, each cubic centimetre of permanganate, representing ferrous iron oxidized by chromate, will therefore represent 0.1% Pb.

The 'lead acid' above referred to is a solution of 65 cc. of strong H_2SO_4 (120 gm.) in 2000 cc. of water, to which solution, while hot, is added with stirring a solution of 0.5 gm. of lead acetate in 135 cc. of water, making about

2400 cc. This solution is allowed to stand for several days to settle, and the clear solution is then siphoned off through a thick asbestos filter for use. The use of this acid makes it unnecessary to consider the solubility of the lead sulphate. If a solution made with 'lead acid' is evaporated to any extent, it should be brought to the original volume with pure water before filtering; consequently, when the lead sulphate is filtered, no more lead remains in the filtrate than was originally added in the 'lead acid.' (Jour. Ind. Eng. Chem., June 1914, p. 548).

The solubility of $PbSO_4$ in pure water was determined by Kohltausch at 4.1 mg. per 100 cc. = 2.80 mg. Pb, and by Fresenius at 4.38 per 100 cc. = 3.00 mg. Pb. Fresenius determined the solubility of $PbSO_4$ in water containing H_2SO_4 as 2.74 mg. in 100 cc. = 1.87 mg. Pb. Recently (I. Schnaal in Compt. Rend., 1909, pp. 1394-1396) found that pure water dissolves 8.24 mg. $PbSO_4$ per 100 cc. at all temperatures, and that, as H_2SO_4 is added, the solubility diminished until, with one part of H_2SO_4 per 1000 of water, the $PbSO_4$ is absolutely insoluble.

Waring, in 1910, collected the zinc sulphate filtrates and washings from 22 assays of 3 gm. each, of zinc-blende ores which were being assayed gravimetrically for lead, without using alcohol. These filtrates were allowed to stand quiet for a week, the light additional $PbSO_4$ sediment filtered off, and the lead in the clear solution carefully determined, with the following results:

	Grammes Pb	Per cent
Original $PbSO_4$ residue	0.4030	0.6105
Sediment from the filtrates	0.0058	0.0090
Final clear filtrate	0.01676	0.0254
Total		0.6449

The amount of lead in the clear filtrate (1880 cc.) represented 8.9 mg. per litre. The samples averaged 59.04% Zn, 2.05% Fe, 0.037% Cu, and 0.176% Cd.

C. E. Heinz has recently evaporated the filtrates from 49 lead assays of 127 gm. of zinc-blende and found in these 0.0248 gm. of lead, representing an average loss of 0.0508% in each assay. The volume of filtrates evaporated was 7250 cubic centimetres.

TUBE-MILL PEBBLES AND LINERS, amounting to 12,000 and 3050 tons, respectively, were produced by domestic deposits in 1917. Imports were valued at $197,156, representing about 15,000 tons. The domestic substitutes for imported flints have given satisfaction and have been no more expensive—some have been less expensive—than the French, Danish, and Belgian materials, facts attested by reports of the consumers in letters to the producers and to the U. S. Geological Survey, and even more emphatically by repeat orders.

A SEMI-OFFICIAL STATEMENT in the 'Rangoon Times' gives the wolfram output of the Tavoy district of Burma as 3652 tons for 1917, against 3036 tons in 1916, and 2115 tons in 1915. The Tavoy district produces 80 to 90% of the wolfram produced in Burma.

Water and Electricity

By T. D. MacCORMACK

Some time ago I witnessed a fire at the Washoe reduction works caused by a short-circuit at an electric switch-board. The pressure was 2200 volts. When the short-circuit occurred, a loud humming noise was caused by the current. Some of the employees, becoming excited at the appearance of such a fire caused by this high voltage, retreated to a safe distance. However, one of them picked up courage and connected the fire-hose to the water-line. After he had done this he took his place at the nozzle to direct the stream onto the fire, and then called on the other men to turn on the water. Fortunately for him, nobody heeded his request. If the water had been turned on he would have been electrocuted instantly, as the water coming in contact with the live wires would have conducted the current through his body, and he would have undoubtedly received the full charge of 2200 volts. When told what would have happened to him if the water had been turned on, he said, "I didn't know that." If the water had been turned on he never would have known. If he had stopped to think twice before acting he could have seen that the better informed men, who understood the danger of trying to extinguish the fire with water, were using the chemical fire-extinguishers, which were available at convenient places throughout the plant. A dangerous practice, of similar kind, is that in which workmen indulge when sprinkling the smelter yards. They sometimes deliberately elevate the stream of water to a height almost sufficient to come into contact with the high-voltage B., A. & P. railway trolley-wires. These lines run through many places in the smelter-yards, and I hope that this may serve as a warning to those men who do not realize the great danger to which they expose their lives by playing a stream of water upon a conductor carrying electric current.—'The Anode,' July 1918.

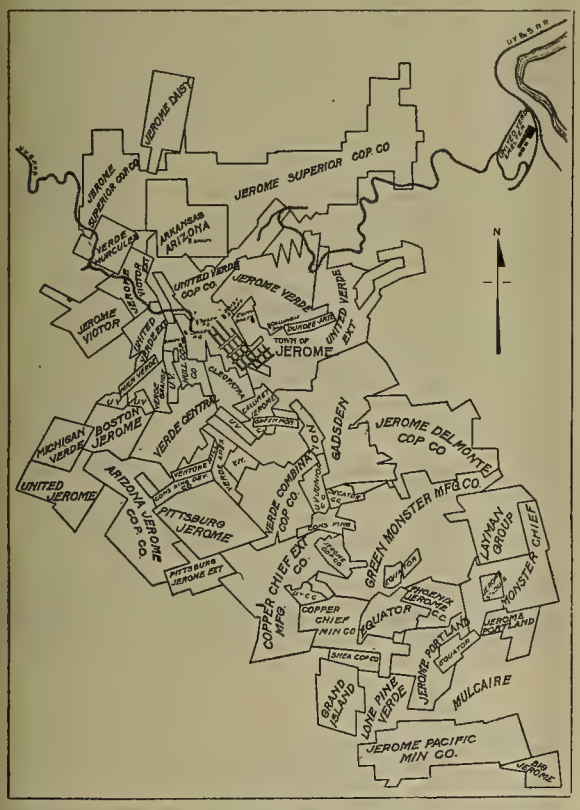
ALUMINUM in the framework of a modern German zeppelin, according to notes furnished to a London journal by a French officer, is used to the extent of 10 to 12 tons. This seems an enormous bulk, as the metal is so light. The covering of the 18 balloons enclosed inside the big outer envelope is made of a cotton substance, lined with 'goldbeater's skin,' instead of with rubber, and the quantity used is so large that the intestines of 30,000 cattle go into the material for one zeppelin. Each of the 18 balloons is fitted with a valve, and separated from those on each side of it by a funnel to carry off the explosive mixture of the hydrogen of the balloons, the oxygen of the air, and the gases given off by the engines. When all five motors are working together, one contained in the forward car, one in each of the two side cars, and two in the rear car, the speed attained is 68 miles per hour, but, as a rule, all the engines are not used at one time, and the normal rate of flight is from 50 to 56 miles per hour. The ordinary crew consists of 22 men.

REVIEW OF MINING

JEROME, ARIZONA

Apex Suits at Verde Denied.— U. V. X. Smelter.

At the end of an interesting talk on the War and conditions in France, James S. Douglas, president of the United Verde Extension Mining Co., on July 30 surprised his audience by denouncing those who were responsible for the circulation of the rumor that the Clark interests are planning to institute apex proceedings against the Extension. Among those who heard him were a number of the shareholders of the company. Mr. Douglas said that the rumor was undoubtedly started by brokers who expected to profit



PROPERTY MAP OF VERDE DISTRICT, ARIZONA

by commissions on sales of stock. He pointed out the impossibility of the apexing of orebodies in the Verde district on account of the fact that there are no veins, the ore lying in deposits. He stated that since a decision rendered in a case from the Warren district about thirty years ago there had been no apex suits in the State of Arizona and that the copper companies had always respected the vertical side-line rights of adjoining properties. He expressed himself as feeling convinced that no company in this district would attempt to follow ore outside of its own side-lines, and stated that the Extension certainly did not intend to do so. Mr. Douglas, in speaking of his company's relations with W. A. Clark and the United Verde Copper Co., said: "Our big neighbors up on the hill have treated us (the U. V. X.) with the utmost consideration. W. A. Clark and Charles W. Clark gave us permission to start our haulage-tunnel on their ground. Without that permission it would have been impossible for us to bring the tunnel into the mine on the 1300-ft. level." For the past two weeks or more rumors have been current to the effect that the Clark interests, through their holdings in the Hull Copper Co., intended to institute apex proceedings against the Extension, and some reports went so far as to state that such a suit had already been filed. That such stories have had an effect is evidenced by the drop in the price of U. V. X. shares, they selling down from $39.50 to $35 about a week ago. Although a number of smaller holders became frightened and disposed of them, the general opinion held here is that nothing would come of such a suit. However, it was feared that the filing of a suit would have the effect of lowering the price. After it had receded to $35, it began to rise, and on June 31 was $38. When the rumor reached Mr. Douglas at Douglas he immediately advised his friends and large holders not to dispose of any. His advice was evidently taken, for not only did they hold on, but it is reported on good authority that a number took advantage of the low prices obtaining to increase their holdings.

Mr. Douglas has announced his intention of returning to France in the fall. In the meantime, after spending some time attending to business affairs in Arizona, he will go to Canada, where he will work in the wheat fields in an attempt to rid himself of hay-fever.

The U. V. X. smelter has been in blast for a number of days and it is reported that the furnace is reducing about 300 tons of ore daily. This amount will be increased soon to the full capacity of 500 tons. No figures relative to the grade of ore being treated have been given out.

BUTTE, MONTANA

Silver and Manganese Ore.—Development on the East Side.

The increased price of silver, coupled with the demand for manganese, has revived leasing in the distinctively silver area of the Butte district. West of the city the Butte-Plutas company, a local syndicate, is prospecting a strong vein in the Plutas claim, never opened before. The property has an electric hoist and air-compressor. The shaft is 125 ft. deep, and a cross-cut is being driven to the vein. A few hundred yards from the shaft is the Norwich claim, under lease and bond to James E. Higgins. Here there are two parallel veins, the northern carrying 3 to 5 ft. of block ore averaging 30% manganese, of which daily shipments are being made. The silicious hanging-wall streak assays well in silver, and will be shipped also. The property is to be prospected to depth by a second shaft. The vein was opened farther west in the 'nineties and extensively mined for silver ore.

The Hibernia mine, in the same area, is being operated by the Davis-Daly company and has a large quantity of ore blocked out.——The Philadelphia shaft, better known as the Nettie mine, is producing 50 to 150 tons per day of silver and manganese ore.

The Germanic group, under development by Butte & Superior interests, with W. F. Murphy as superintendent, is cross-cutting to the Tzarina lode, the biggest and most prominent vein in the district. Despite its size and most attractive outcrop, it has never been opened below 100 or 200 ft. by its owners. The same vein farther east, in the Ancient claim, has yielded quite pure rhodonite (manganese carbonate) ore, carrying a few ounces of silver. Shipments of this ore are being made by W. A. Clark, from the Travona shaft, re-opened within the past year.

A half dozen lessees are at work on various tracts in the western section, getting out the manganese-silver ores of the oxidized zone, mostly by windless work.

To the north, the Anselmo mine, in the heart of the new residence district, near the School of Mines, is being operated for New York interests by Joseph A. Pyle. Within the last month there was shipped 2000 tons of complex zinc-lead-silver ore to the Anaconda company's zinc plant. The mine is 500 ft. deep and has a full electric equipment of hoist, compressor pumps, etc. The Anselmo is west of the Gagnon mine, and is supposed to carry the western extension of the Parrot-Original-Gagnon lode.

Near the reservoir, and west of the Centerville section of Butte, is the Evelyn mine, purchased last year by W. A. Clark and operated until a few months ago. The veins are large but low grade, and as driving on the 500-ft. level did not come up to expectations the mine is temporarily closed down.

On the Rainbow lode, the great silver lode whose massive outcrop of black-stained quartz practically delimits the copper-bearing area of Butte for the outlying undeveloped 'silver' area, the Alice mine is being operated by the Anaconda company. The Moulton mine, farther west, is operated by Mr. Clark, and the adjacent Amy Silversmith under lease by Ellingwood & Richards. The Goldsmith mine, the next mine west, is now being re-opened by the Crystal Copper Co. This was a bonanza producer of former years, yielding over 1,500,000 oz. from one vein, opened to a depth of 367 feet.

A new electric equipment has been erected at the old Troy shaft, re-opened, re-timbered, and sunk 100 ft. deeper. Cross-cutting is now under way to reach the north vein, about 60 ft. from the shaft. Mr. Hill is mine superintendent.

In the eastern section of the district, the old Butte & Bacorn company is still prospecting its vein, so far without success. It is understood that a shut-down is expected as a result of the 50c. wage increase granted by all companies early in July. The Main Range mine of the Tuolumne company continues to ship 60 to 75 tons of ore daily from stopes above the 700-ft. level on the Spread Delight vein. The cross-cut on the 800-ft. level reached the vein recently, making connection with the winze sunk from the 700-ft. level. The hanging-wall streak of crushed quartz in the vein carries a high silver content. It is interesting to note that the shipments of ore from the mine in 1917, returning over $200,000 from the smelter, averaged about 2.7% copper but contained over 8 oz. of silver per ton, which is probably the record for silver content from any of the copper mines here.

South of the Tuolumne company's holdings, the Sarsfield shaft of the North Butte company is showing an attractive outcrop, at the base of the Continental Divide range, the mountain ridge which shuts in the district on the east. The mine has good oxidized ore of shipping grade at the surface, but the deep work is expected to determine the value of the 'east side' holdings of the company, for which it has already spent over $1,500,000, and on which its future rests.

The Nipissing company of Cobalt has given up its option on the stock of the Copper Czar mine, after spending $100,000 on the property. The tract shows a deceptively-stained outcrop of altered granite, with a 5-ft. quartz vein in the centre. In recent operations the shaft was deepened to 300 ft., and 900 ft. of cross-cut work done; but the veins encountered appear to be merely 'roots,' according to local opinion. On the slopes above, Ed. Hickey, operating the Honolulu, has taken out some excellent gray copper and chalcopyrite ore from the Receiver vein. The Receiver mine is still operated under lease.

In the heart of the city, lessees working on the Syndicate lode claim, near the Belmont shaft, have taken out ore of unusual character from the stopes on the 125-ft. level. This ore carries chalcopyrite, zinc, and no glance, though it comes from an east-west vein.

The outlying districts show less activity than usual, owing to the high cost of supplies and high wages. A strike of ruby silver ore was made last week on Linlow creek, near the old Ruby mine. It promises to be another producer of high-grade ore, similar to the Ruby & Columbia. The ore is an altered rhyolitic rock.

MATAQUESCUINTLA, GUATEMALA

General Notes on Silver and Chrome Mining.

In Mataquescuintla county, the Mataquescuintla Mining Co., owners of El Rosario, Los Ocotes, and Magdalena mines, has just completed part of the work of re-opening and unwatering the old San Francisco workings. This mine was exploited by a native company in 1888. It erected a 20-stamp mill. Considerable chloride of silver was found in the mine, yielding over 300 oz. per ton. The ore actually available in the workings so far cleaned out, amounts to 600,000 tons, averaging $34 per ton. In El Rosario mine an adit is being driven to cut the vein below the San Francisco level. Average samples taken every 10 ft. across the vein in this mine assay from 0.01 oz. gold and 7.4 oz. silver per ton to 6.01 oz. gold and 54.20 oz. silver. The property is said to be for sale.

A rich vein of stibnite (antimony sulphide) was discovered in this district recently. It promises to develop well. Considerable work is being done at La Montanita mine, on a vein of lead carbonate, carrying silver.

In Casillas county, the San Bernardino and Santa Clara mines have large quantities of ore ready for shipment. It carries from 100 to 180 oz. of silver per ton and 50 to 70% lead.

In Jalapa county the chromic-iron deposits of Potrero Carrillo and Patachee, owned by the railroad company, are being worked. Ore is shipped every month to New York. The property will soon be on a large producing basis. The ore assays 59% Cr_2O_3. B. T. Wells is manager.

The Silver Lead Mining Co. recently found a wide deposit of pyrrhotite, containing nickel and cobalt. It is near Sansare, 9 miles from rail. A large quantity of ore is available for immediate extraction. Early shipments are to be made.

VICTORIA, BRITISH COLUMBIA

Chrome Deposits.—Demand for Base Metals for Shells.—A Future Gold Producer.—Geological Survey.—Ore-Testing.—Roads and Trails.—Abrasives.

Chrome deposits in this Province will probably be developed. W. J. Nicholls and associates of Spokane, Washington, have secured claims at Cascade, B. C. The property was purchased after an examination by George Crerar, of Spokane. The chrome at Cascade has been reported on by the Provincial Mineralogist. The deposit to which he refers, no doubt the same as that in question, is within 4000 ft. of the C. P. R., and in the Grand Forks Mining division. P. B. Freeland, resident engineer, said last year that little development had been done. Ore carries from 30 to 50% Cr_2O_3 and was worth investigation. There were 250 tons on the dump, and the owners were trying to get a permit to

ship it. The serpentine rock carries 3 to 10% chrome. W. M. Brewer, resident engineer at Nanaimo, reported in 1915 that chrome existed on Scotty creek, near Clinton. The claims had been staked, abandoned, and then re-opened. Little development had been done. Selected samples ran 33%. Some low-grade ore might be concentrated, but development was not such as to admit of any estimate of quantity.

As the Kootenay and Boundary districts are producers of lead, zinc, and copper, it is expected that mining will be considerably accelerated as a result of orders received in Canada from the British government for a large increase in shrapnel

Considerable development is being done on the Molly Gibson gold-silver mine in the Nelson district. A tunnel is being driven 160 ft. below the upper workings to get in below the orebody and allow the rock to be stoped down and taken out by gravity, thus considerably reducing costs. Those interested believe that it is destined to prove one of the big gold producers of British Columbia. A shipment to the Trail smelter yielded $22.76 per ton. The Provincial Mineralogists' report for 1917 shows that work was started in July at the mine, and in August at the mill. Some 367 tons of crude ore was shipped to the smelter. The mill dressed 1759 tons, yielding 134 tons of concentrate, which was not shipped. A flotation plant was installed and a Hardinge ball-mill was to be put in. Fifty men were employed.

The Geological Survey of Canada is to establish a permanent office in this Province, with Charles Camsell in charge. This will be a great aid to local mining.

An experimental ore-testing plant to cost $50,000 will probably be established by the Dominion government in British Columbia before long. The works may be at Vancouver or New Westminster, near rail and water transportation. This will be another great benefit to the Province, as in the past many unsuitable ore-treatment plants have been put up by mine-owners in the Slocan and Boundary districts, simply for the want of good advice. "If we had had such an experimental plant years ago," stated a mining man recently," most of the mills of the Slocan would be showing a recovery of between 90 and 92% instead of, in some cases, only between 60 and 65%."

It was stated by the Minister of Mines during the recent session of the Provincial Legislature that of the $200,000 voted in 1917 for mineral development, by way of assistance in trail and road construction, the sum of $142,000 had been spent. He said that an additional $75,000 was provided in the estimates for 1918 for a continuance of the policy. Out of $100,000 provided in 1917 for assistance to mines by way of engineering advice, drilling, etc., a total of $21,000 had been spent, and $25,000 more had been provided for the current year.

Inquiries are being received by British Columbian mining officials as to the resources of the Province in regard to infusorial earth, tripolite, or kieselguhr. It is explained that it is required in Great Britain, especially at Manchester, in the manufacture of asbestos. Before the War this mineral was imported from Russia and France, but the supply is now unavailable. British Columbia has considerable quantities of infusorial earth, probably the best known deposits being situated 20 miles north of Savona, B. C., a C. P. R. station, where there are beds up to 30 ft. thick. In view of the demand it is thought likely that active development will be undertaken in the course of the next few months.

Fatal accidents in metal mines during the first half of 1918 total five, against nine in 1917. In the coal mines there were six compared with forty.

There will be eight parties of the Geological Survey branch of the Dominion Mines Department in the field in British Columbia this summer. Several are already at work. As there are only 25 such parties in Canada this year, the comparatively large proportion assigned to this Province is taken as an indication that the Dominion authorities are recognizing to a greater extent than ever its importance.

GOLD HILL, OREGON

Gold and Chrome Operations.

The lessee of the Ray & Haff gold-quartz claims, J. G. Davies of Sacramento, three miles north of Gold Hill, has made another important strike after a year's work. The ore is galena, carrying from $18 to $30 per ton in gold.

The Red Oak gold-quartz claims, on Galls creek, four miles south of Gold Hill, an old producer of rich ore, has been sold to R. E. Doan of Gold Hill, and Portland, Oregon,

ALONG THE ROGUE RIVER, OREGON

associates. The property has been idle for 20 years, so it is to be re-opened at once.

Grants Pass.—R. J. Rowan, engineer in charge, reports that the Golconda chrome mine, with several other small mines worked in connection in the Waldo district, shipped 450 tons chrome ore in May, 1035 tons in June, and 1450 tons in July. There will be a slight increase over July shipments during the hauling season from Waters creek.

Medford.—The Anderson gold mine, an old-time producer closed down for 10 years, situated in the Ashland and Shorty Hope group zone south of Talent on Wagner creek, has been sold for $30,000 on a 60-day option by B. W. Worthington, L. D. Corbett, and M. A. Carter, of Medford, to Seattle men.

SUTTER CREEK, CALIFORNIA

Summary of Keystone Mines Report for Half-Year.

The Keystone Mines Co. of Amador City has issued a report for the six months ended June 30, 1918. Gold and concentrates sold realized $84,947 net. After paying for operations, taxes, interest, etc., the cash balance was $6110, compared with a balance of $5635 at beginning of the period. The indebtedness remains at $20,423. An advance in wages was made on May 1, but a shortage of men is felt. Supplies are higher, and an increase in power rates is expected. There is estimated to be more ore blocked out than at the end of the last period. The 2100-ft. level cross-cuts are to be continued. They are in greenstone. A stope 80 ft. above the 1200-ft. level shows 8 ft. for a length of 100 ft., of average grade. A large tonnage is available at 1400 ft. A station—38 by 42 by 10 ft.—has been cut at 2100 ft. The 900, 1000, 1200, 1400, and 1800-ft. levels yielded a total of 43,694 tons for the mill. The 40 stamps lost only 17 hours. Gold recovered by amalgamation was worth $4164, and from 2216 tons of concentrate $108,226, a total of $112,390. Freight and smelter deductions amounted to $26,588. Amalgamation saves very little of the gold now.

ARIZONA

Ajo.—On July 22 the New Cornelia company set off a large blast on hill No. 3 in the steam-shovel pit, using 68,000 lb. of powder. A week or so previous 40,000 lb. was exploded. In February, 50,500 lb. broke 200,000 tons of ore. Five shovels are at work now.

Aguila.—A small gasoline hoist is to be put on the manganese mine of John Rogers, who is in the market for same.

Bisbee.—Lessees at the Higgins property have until February next in which to extract ore, and locally it is said that they will make large profits. The present lessees were mining in the Southwest mine of the Copper Queen, but concluding that the vein went into Higgins ground, acquired it. Estimates show 30,000 tons of at least 35% ore available. Daily shipments to smelter amount to a carload of this rich ore.

Globe.—Arizona Commercial is reported to have opened high-grade bornite on No. 14 level east. Ore is now available between No. 7 and 14 levels.

The Iron Cap Copper Co. proposes to call in the present $125,000 outstanding 5-year 7% bonds due in 1921, and issue $500,000 8% 20-year bonds.

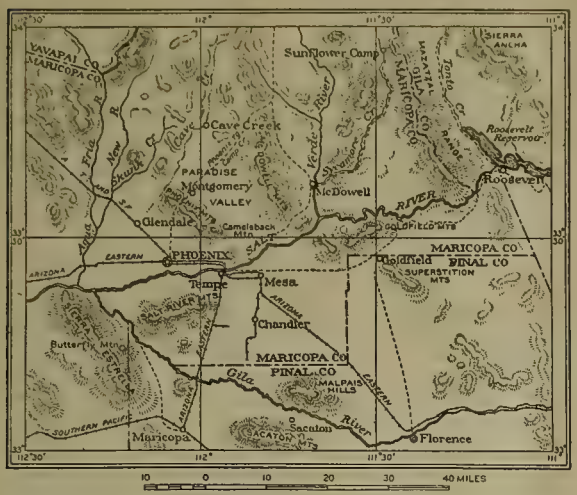
Holbrook.—A manganese property has been purchased by S. G. Mayfield, Box 38, who is in the market for concentrating machinery.

Jerome.—On July 30, the Labor Union warned mining companies that a strike would start the next day if their demand for an advance of $1.10 per shift were not granted. The Federal Mediator, Hywell Davies, had offered 50 cents. On July 31 the men accepted 75 cents, with reductions in rent, light, and water, of company houses.

Ray.—The Ray-Kelvin Mining Co. has issued its prospectus. The capital is 2,000,000 shares, $1 par. Arthur L. Kelley is vice-president and mine superintendent. The property adjoins the Ray silver-lead mine on the north, and Troy on the south. On the Continental claims there are numerous indications of copper. Lead-silver ore has also been opened. On the Last Chance group two tunnels are in iron for their full length, the iron carrying copper carbonate and chalcocite. The Marble King contains a large outcrop of iron and garnet. The sulphide zone is considered by the engineer, Mr. Kelley, to be near the surface. In this district is the Ray Consolidated, mining 300,000 tons of copper ore per month; the Ray Hercules is about to start its 2000-ton mill; the Ray Silver-Lead is shipping 700 tons per month; the Broken Hills is developing gold-lead-silver ore, also shipping; the Troy is opening copper ore; the Chilito has lessees on copper ore; the Apex is producing gold ore; the London Arizona is mining 200 tons of copper ore monthly; the Christmas is producing 7500 tons of copper ore per month; and the U. S. Vanadium Co. is developing vanadium ore.

Phoenix.—In Bulletin 690-D of the U. S. Geological Survey, F. C. Schrader describes the quicksilver deposits of the Phoenix mountains. These constitute an outlying desert range in Maricopa county. Mercury was discovered here by L. L. Brunson of Phoenix in March 1916. Copper has also been worked. The rocks of the area are metamorphosed sediments of pre-Cambrian age. They consist chiefly of quartz-schist, sericite-schist, slate, argillite, limestone, quartzite, kyanite-schist, and jasper, and crop out in belts or zones trending north-northeast diagonally across the range. They dip steeply to the south-east and are cut by cross-faults. The quicksilver deposits occur in two or more of the schist belts, in zones of shearing or fracture that parallel the lamination in the enclosing schist. These zones trend approximately N. 30° E. and stand nearly vertical. They range from 5 to 40 ft. or more in width, though generally without definite walls, and some have a known length of more than a mile. The deposits consist mainly of portions of the country rock that have been more than normally crushed and made schistose and later mineralized. They contain numerous specks, veinlets, films, small bodies, and crystals of cinnabar and meta-cinnabarite—the black secondary sulphide of mercury. A few globules of native quicksilver associated with the cinnabar ore have been reported from the Rico prospect. The gangue minerals—the chief constituents of certain stringers and veinlets—are quartz, calcite, hematite, and limonite. Kyanite and tourmaline are locally abundant in the ore, but are probably residual constituents of the replaced wall-rock. The ore-bodies occur largely along the planes of schistosity in the schist. Associated with the quicksilver minerals and occurring also independently of them are copper minerals, especially malachite, chalcocite, and a little chalcopyrite. In one place minute white metallic veinlets, thought to be stibnite or molybdenite, are present. The croppings of the lodes in general are not prominent but weather even with or below the surface of the adjoining country rock, with the result that most of the best exposures occur in the edges of washes or smaller channels of erosion. From the present development of the deposits it is impossible to estimate their ore-reserves. Three of the properties—the Mercury, Rico, and Seal Rock—have workable ore which averages 3% or better in quicksilver and which, to judge from the persistence of the lodes, probably has considerable horizontal and lateral extent. Likewise, from the constancy or improvement of the ore in depth so far as developments now extend, it seems that the ore may be expected to continue to reasonable depths, especially in the oxidized zone. From the accessibility of the deposits and their nearness to railroad and supplies, it is probable that ore averaging as low as 1% can be profitably worked with the metal at its present market price. The occurrence of the Mazatzal and Phoenix deposits on the same line of strike by no means implies continuity of the deposits throughout the intervening distance. It may be worthy of note, however, that the line of strike connecting the two areas crosses the northern part of the intervening McDowell mountains, which, so far as known to Mr. Schrader, have not been prospected for quicksilver. This alinement, taken in connection with the fact that these mountains are composed of rocks that are of the same classes and have the same general attitude as those in the Phoenix and Mazatzal areas, suggests that this part of the McDowell mountains, separated from the Phoenix mountains by Paradise valley on the west and from the Mazatzal mountains by the Verde river valley on the east, may be worthy of inexpensive prospecting. The

line of strike of what may possibly be a quicksilver belt should cross the McDowell mountains about 4 miles south-east of the road between Phoenix and Camp creek, or 12 miles from the Phoenix area. Accordingly, the more likely field in which to prospect in these mountains embraces an



SKETCH-MAP OF CENTRAL ARIZONA

area extending from the vicinity of Pinnacle mountain, 4 or 5 miles south-east to Mountain spring or McDowell peak. Owing to the cover of valley fill on the east, the west slope of the mountains will doubtless be found better exposed for prospecting, but the belt also includes Fraesfield mountain and other hills on the north-east.

CALIFORNIA

Auburn.—The Steele Chrome Co., managed by E. C. Montgomery, has commenced the erection of a 150-ton concentrating mill for its chrome ore on the property 12 miles from Auburn in El Dorado county. The mill will consist of a Hardinge ball-mill, Bunker Hill screens, classifier, and Deister sand and slime tables. The mill was designed by Mr. Montgomery and is being erected under contract by Cahill & Vensano Co., of San Francisco. A. H. Jarman is president. Elwin Benner is constructing foreman.

Berkeley.—An acid-proof pump is wanted by F. O. Packard of 2609 Milvia street.

Los Angeles.—The Holden Metallurgical Co. of 521 East 4th street is in the market for a second-hand steam drag-shovel, with 50 to 75-ft. steel boom, 40 to 50 hp., to be complete with cables and mounted on traction wheels, the bucket to hold ¾ to 1¼ cubic yards.

Porterville.—'Magnesite in 1917,' advance chapter of 'Mineral Resources of the United States,' has been issued by the U. S. Geological Survey. The output of Tulare county was 63% (133,347 tons) of the total crude (211,663 tons) magnesite mined in the State and 64% of the calcined product. Twenty-three mines reported production last year. The most productive was the Porterville Magnesite Co.'s property. Its output was greater than in 1916. Two large rotary furnaces calcined over half of the mine's output. The Tulare Mining Co. has two vertical kilns, and calcined its total output. The American Magnesite Co. did custom work, operating two 50-ton rotary kilns.

Portola.—The International Smelting Co. has finally taken over the Walker copper mine. The price was $1 per share for 630,000 shares of the 1,250,000 shares issued. The 90-ton flotation mill continues to work steadily.

San Francisco.—A small electric hoist using alternating current, a compressor, and a machine-drill are required by A. T. McElvaine, care of G. F. Stoner, 984 Market street. This outfit is for prospecting.

COLORADO

Climax.—Mining and milling molybdenite here is described by D. F. Hailey for the Colorado meeting of the American Institute of Mining Engineers. Climax is at an elevation of 11,300 ft., on the D. & R. G. railroad, 14½ miles north-east of Leadville. The main working tunnel of the Climax Molybdenum Co. is at 12,200 ft. Climatic conditions are severe. The American Metal Co.'s engineers examined the deposit first in 1916. Assays varied from 0.4 to 1.2% MoS_2. A ton sample obtained from mine-car samples indicated a recovery of 12 lb. per ton of ore, equal to 0.6%. Milling so far has recovered 0.92%. The ore occurs as an intricate system of fine stringers evenly distributed through the alaskite formation. Oxidation is prominent to 350 ft. below the surface. Iron pyrite and very little copper are the associated minerals. The thin outer edge of the orebody will be mined by open-cut method in the summer, while underground work will be by shrinkage-stopes. In the tunnels, 30-lb. rails have been laid. The ore is dressed by jaw-crushers, ball-mill, crushing through 20-mesh, Dorr duplex classifier, the overflow going to flotation machines, the sand passing through another ball-mill until fine enough for overflow—120-mesh. The flotation plant includes five Janney air-mechanical machines, three Callow standard roughing-cells, and two Callow half-size cleaner-cells. As there is three times as much pyrite as molybdenite, and a concentration ratio of 115 or 120 to 1, the flotation operation is a delicate one. Concentrate averages 65% MoS_2. A new vanner will remove the pyrite and increase the grade of concentrate by 2.2% MoS_2. The mill concentrates 300 tons of ore daily. A year ago Climax was a barren area; by February 1918 the plant was in operation. Comforts of the men are given considerable attention.

Cripple Creek.—The Vindicator Consolidated paid 3c. per share last month, equal to $45,000. This makes $3,757,500 to date. During the second quarter of 1918, there was mined 64,194 tons of ore, yielding 5105 tons of shipping product, including flotation concentrate. Lessees opened a new vein on No. 11 level, giving the company substantial royalties. Net current assets are over $300,000.

Silverton.—Mines that have been idle for years are now being re-opened. Among these one of the most interesting is that of the Veta Madre, one of the oldest claims in the district.——The Bandora will be operated by the owner, William Sullivan, after an idleness of four years.——The Joe and John property, a heavy producer in former years, will be re-opened under lease. At the close of 1917 the mine was in condition for shipping.

The Caledonian mill is being re-modeled, concentrating tables and flotation apparatus being put in.

The Mears & Wilfley company will work its tailing plant on a larger scale than formerly. The Arastra basin, at Waldheim, wherein the Silver Lake properties are situated, will be the scene of considerable activity during this season. In addition to operation of the tailing plant mentioned, many lessees have taken up various properties in the basin, indicating that a large tonnage of lead ore will be mined.

IDAHO

Kellogg.—The Nabob Consolidated on Pine creek is to start shipping 300 tons daily of selected lead-zinc ore. A 4000-ft. aerial tram connects the mine with rail, or where the O.-W. R. & N. line will be constructed. W. A. Beaudry is manager.

Mackay.—On July 1 the Empire Copper Co. paid 5c. per share, equal to $50,000. This makes $100,000 for 1918 and

$880,000 to date, since 1913. Two years production was as under:

Year	Tons	Value
1917	66,807	$1,139,110
1916	69,475	1,380,314

Leasing was eliminated during 1917. There are now 125 men employed, against 225 previously, according to the general manager, F. A. Behling. The mine is worked from tunnels. Present shipments assay 4 to 5% copper, 1 to 6 oz. silver, and 50c. to $1.50 gold per ton. There is a large quantity of 2 to 3% ore awaiting milling. Among the many recent improvements is a 16,270-ft. Trenton-Bleichert aerial tram, replacing a 7½-mile Shay locomotive railroad. This cost $130,000, but will reduce transportation charges by 80%.

Mullan.—The National Copper Mining Co. has completed improvements to its 500-ton mill, which has been operating on a 220-ton basis.

MISSOURI

Joplin.—Production of the region last week was 6463 tons of blende, 53 tons of calamine, and 1668 tons of lead. These averaged $52, $32, and $100 per ton, respectively. The total value was $508,181, making $14,190,051 for 30 weeks. Missouri contributed $159,929 last week.

St. Louis.—The American Zinc Institute adjourned on July 30, after a successful meeting. The final organization committee appointed to formulate plans, constitution, and by-laws, were Victor Rakowsky of Joplin, J. L. Bruce of Butte, E. N. Wolf of Peru, Ill., A. S. McMillan of St. Louis, A. P. Cobb of New York, W. F. Rossman of St. Louis, and C. T. Orr of Webb City, Mo. They have full power to propose all plans for the formation of a permanent organization. These suggestions will be submitted by mail to members for vote of approval within 60 days. It was proposed at the meeting that a research bureau be organized for new uses of zinc. United political action on all laws affecting the industry was proposed, also co-operation in marketing and selling contracts.

MONTANA

Butte.—Zinc concentrate from the Butte & Superior is being sent regularly to the electrolytic plant of the Anaconda company. The reason for this is the restricted quantity accepted by the American Metal Co., namely, 5000 tons per month.

On July 29 a big first-aid field day was held here. There were 19,000 people present. The mines were closed for the day. The committee received entries from the following: Butte & Superior, two teams; North Butte, one team; Elm Orlu, one team; Timber Butte mill, one team; East Butte, one team; Davis-Daly, one team; Anaconda, 29 teams—total, 36 teams. One, two, and five-man problems were worked out. A drilling contest, with $100 and $50 for first and second prizes, was held. C. and J. Bedell won this, drilling 27⅞ inches in 10 minutes. J. Thomas and A. W. Husband were second with 22 inches.

Renova.—Manganese deposits in Madison county, near Cherry and Wigwam creeks and in the foothills east of Jefferson valley, 70 and 30 miles south-east of Butte, are described by J. T. Pardee in Bulletin 690-F of the U. S. Geological Survey. The orebodies are small, but contain ore that is almost free of silica. The manganese is primarily of sedimentary origin. In the Cherry and Wigwam Creek areas the deposits are underlain by dark-brown to light-gray limestone. Not much work has been done, and several hundred tons are available. At the deposits near Renova, the Iron King claim is overlain by limestone. At this and the Iron Blossom claims there is exposed several hundred tons of manganiferous-iron ore and several thousand tons of iron ore.

NEVADA

Nolan.—The Jumbo Copper Mountain company, in the Rand district of Mineral county, has cut the vein on the 380-ft. level of No. 3 shaft. At this depth the rock is a limestone-porphyry contact. Lessees extracted over $80,000 from the east orebody above 150 feet.

Reno.—In co-operation with the American Mining Congress and with the support of numerous Western metal producers' associations, the Governor of Nevada, Emmet D. Boyle, has called a conference of gold-producers and economists interested in the critical situation in which the gold-producers today find themselves, to meet at Reno on August 12, 13, and 14 for the purpose of discussing ways and means to stimulate the production of gold in the face of ever-increasing operating costs which at this time actually threaten the industry in the West.

Virginia City.—Operations on the Comstock lode comprise the following, according to Whitman Symmes: In the Mexican, work is to be started immediately, both north and south, on the 2300-ft. level. This is justified by the work already done from the winze below 2300 ft., which indicates the dimensions and strength of the vein. The work will open ground that is untouched from 2500 ft. to the surface. ——In the Union raising is under way to catch the downward extension of the orebody from 2500 ft., which was strongly outlined in the floor of the 2500-ft. level for a long distance. This ore should be encountered soon, and the south half of the Union mine will be laid open for exploration by the north drift from the 2300-ft. level, now nearing the Mexican-Union line. The face is in ore of good grade and the ground ahead is full of interesting possibilities.——Ore of usual grade is being extracted from several points in Con. Virginia from 2200 ft. up to within a short distance of the 1900-ft. level. There are several other points where ore conditions are promising, from 2200 up to 1900 ft. and above.——In the Ophir work is being advanced as rapidly as possible, and energy is being directed to some promising ground above the 2000-ft. level.

NEW MEXICO

For the first six months of 1918 the output of mines in New Mexico shows small decreases in gold, silver, lead, and zinc, but a small increase in copper, according to Charles W. Henderson, U. S. Geological Survey. The Mogollon silver-gold district continued its activity, as did the Chino and Burro Mountain copper mines. The Santa Fe Gold & Copper Co. was idle. Lead ore from Magdalena fell off, but that from Organ was heavy. At Steeplerock the Carlisle mill is closed. The zinc output of Magdalena was slightly less. Hanover continued production of carbonates and sulphides.

Jarilla.—A concentrating plant is to be erected by J. J. Murray at the Eddy mine.

OKLAHOMA

Picher.—Production of the districts last week was 4193 tons of blende and 1079 tons of lead, valued at $329,916.

TEXAS

The U. S. Geological Survey reports that the Presidio silver mine was in continuous operation during the first six months of 1918, that desultory mining was also carried on during that period in the Van Horn and Sierra Blanca districts, and that several shipments of copper ore were made from deposits in the Red Beds of Foard and Knox counties. The result was a small output of copper and lead, and an output of silver for the six months of fully 300,000 ounces.

Barstow.—Edward Hart of Barstow, and associates, will construct a short railroad to the sulphur deposit in Culberson county that they are developing. They also propose to erect a sulphuric-acid plant.

UTAH

Alta.—The Alta T. & T. Co.'s tunnel was in 3450 ft. at the end of June. The face is in a shale. A promising fissure has been opened.

Bingham.—The Utah Consolidated Mining Co. has started suit against the Utah-Apex Mining Co., alleging trespass and wrongful extraction of ore worth not less than $500,000. The property involved is the Yampa Extension Northeast Lode claim, purchased by the Utah Con. in 1903. It lies above the ground of the Utah-Apex, and is supposed to contain the outcrop of the limestone formation in which Utah-Apex found a large orebody last year. The ore in dispute between the Utah Metal and Utah Con. companies, in the Malloy lime-bed, is now being examined by engineers.

Utah-Apex company pays 25c. per share on August 10. The last distribution was in October 1917.

WASHINGTON

Spokane.—The American Smelting & Refining Co., represented by Preston Locke, has taken an option for $60,000 on three tungsten claims on the Spokane Indian reservation from W. B. Ridle of Spokane and John Van Horn and H. Stiles of the Deer Trail district. The option follows an investigation covering several weeks and has caused much interest in mining circles. The claims optioned are three of several that have been located. The owners have done surface work at many places and have driven two or three short tunnels. The ore is wolframite. There is considerable ore exposed. All these claims are leased from the Indian department.

CANADA

British Columbia

Anyox.—The strike at the Granby Consolidated works here, started by the electric employees, has been called off.

Ladysmith.—The smelter of the Ladysmith Smelter Corporation was to be blown-in on July 29. This was originally scheduled for June 20, but a steady supply of ore could not be arranged until now. The company has a bond on the Willow Grouse mine on Cowichan lake, and the Girtwood mine on Latouche island, near the Beatson mine, southeastern Alaska.

New Hazelton.—A high-grade ore-shoot, 17 ft. wide, is said to have been opened by the Rocher de Boule Mining Co. To find this ore a low-level tunnel was driven without result, but a streak of ore was noticed and it was decided to raise on this. The shoot was found at an elevation of 160 ft. above the main level and, according to report, it has a large prospective value. A mill is to be erected to treat the lower-grade ore.

MEXICO

Nuevo Leon

Monterrey.—A. U. S. Consular Report, dated June 30, contains the following notes on crops in certain States:

Reports from the State of Coahuila would indicate a particularly good wheat crop for the current season. The present price of flour at Saltillo, the capital of Coahuila, is ₱18.75, equivalent to $11.86 U. S. currency, for 112 lb. An exceptionally good cotton crop is also anticipated in that district. The forecast of corn crops in Nuevo Leon and Coahuila is very good, about three times that of the previous year. The present price of corn at Monterrey is $23 U. S. per carga of 138 kg. (304 lb.). It is expected that during the early part of July the price will drop to $21, and continue to drop to $12 or $18. From January 1 to June 30, 1918, there has been brought into Monterrey from the States of Sinaloa, Sonora, Vera Cruz, Mexico, and the United States approximately 15,000 tons of corn. The prospects for the bean crop in Nuevo Leon and Coahuila is also good, 50% higher than in 1917.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

Walter M. Briggs is at Santa Barbara.

A. Garcia is here from Yucatan, Mexico.

J. B. Timms, of Phoenix, Arizona, is here.

R. H. Knapp, of Colorado Springs, is here.

F. A. Beauchamp has gone to Octave, Arizona.

A. E. Hepburn, of Vancouver, B. C., was here last week.

A. G. Charleton is working for the Ministry of Munitions in England.

H. H. Nicholson is examining cobalt and nickel deposits near Leesburg, Idaho.

L. H. Goodwin has entered the employ of Rogers, Mayer & Ball as field-engineer.

C. F. Kelley, vice-president of the Anaconda company, was at the Palace hotel on August 2.

Ernest V. Pearce has returned from the United States to England and joined the firm of W. E. Moulsdale & Co., at Liverpool.

William Wraith, general manager for the International Smelting & Refining Co., will move his office from Salt Lake City to New York.

Thomas B. Stearns, of Denver, Food Commissioner in Colorado, was in San Francisco this week and is now on his way to Salt Lake City.

James S. Douglas is at Jerome, Arizona, on a short visit from France, where he is in charge of the distribution of supplies for the Red Cross.

H. G. D. Reynolds has returned from Siberia, where he was connected with the Irtysh Corporation, Ltd., and will reside in Los Angeles, California.

S. R. Coghlan, formerly assistant superintendent at the Cerro de Pasco smelter, Peru, and more recently a magnesite operator at Porterville, California, has been appointed chief gas-officer at Camp Funston, Kansas, with rank as First Lieutenant.

Obituary

Forbes Rickard Jr., Lieutenant U. S. Army, eldest son of Forbes Rickard, Denver, was killed in action near Bailleul, in France, on July 19.

Henry E. Vail, a pioneer miner of Butte county, California, who also was prominent in organizing dredging companies at Oroville, died at Chester, Plumas county, on July 30. He was born in 1842.

Randolph Adams died at New York on July 9. After graduating from Columbia in '83, he worked at the Silver King mine, Arizona; Broken Hill, Australia; Tennessee copper mine, Tennessee; retiring in 1908. He leaves a widow and two daughters.

John Duer Irving, Captain, 11th Engineers, died of disease in France, according to a casualty-list published on August 1. At the time of voluntary enlistment in the Engineer Officers Reserve Corps he was professor of economic geology at Yale. Born in 1874, he was 44 years of age. A graduate of Columbia in 1896, he devoted his whole career to geology, first with the U. S. Geological Survey, then as professor at Lehigh and Yale universities successively. For many years he was first assistant to S. F. Emmons and co-operated with him in preparing several notable monographs. He was a gentleman, a scientist, and a soldier.

THE METAL MARKET

METAL PRICES

San Francisco, August 6

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30— 9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

The Mint at San Francisco has been authorized to receive crude or manufactured platinum for Government purposes.

ORE PRICES

August 6

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—$8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 54%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$24

In spite of the urging of the Government that chrome production be increased, producers are having some difficulty in marketing their product.

In describing the molybdenite mine at Climax, Colorado, in a paper prepared for the A. I. M. E., D. F. Hailey says that at present the market for molybdenum is very limited; and the quoted prices ($1.25 per lb. of 90% MoS_2) are nominal, and do not at all represent the prices at which the material is marketed.

'Magnesite in 1917,' advance chapter of the U. S. Geological Survey, has been issued. The output last year was 316,833 tons, averaging $9.15 per short ton. California contributed 211,663 tons, a gain of 37%; and Washington 105,175 tons, against 715 tons in 1916. Consumers of this ore are given in the report.

'Strontium in 1917' has also been published. Buyers' names are given. Celestite prices ranged from $20 to $22 per ton, and for strontianite $35 to $90.

'Cadmium in 1917,' covering output, prices, and names of producers, has been issued by the U. S. Geological Survey.

'Talc and Soapstone in 1917,' giving output, prices, and uses, has been issued by the U. S. Geological Survey.

EASTERN METAL MARKET

(By wire from New York)

August 6.—Copper is quiet, though strong. Lead is scarce and steady. Spelter is inactive and easy.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange.

Date	New York, cents	London, pence
July 31	99.62	48.81
Aug. 1	99.62	48.81
" 2	99.62	48.81
" 3	99.62	48.81
" 4 Sunday		
" 5	99.62	48.81
" 6	99.62	48.81

Average week ending	
June 25	99.50
July 2	99.50
" 9	99.62
" 16	99.62
" 23	99.62
" 30	99.62
Aug. 6	99.62

Monthly averages

	1916	1917	1918
Jan.	56.76	75.14	88.72
Feb.	56.74	77.54	85.79
Mch.	57.89	74.13	88.11
Apr.	64.37	72.51	95.35
May	74.27	74.61	99.50
June	65.04	76.44	99.50
July	63.06	78.92	99.62
Aug.	66.07	85.40	....
Sept.	68.51	100.73	....
Oct.	67.86	87.38	....
Nov.	71.60	85.97	....
Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. Quotations in cents per pound are as under:

Date	
July 31	26.00
Aug. 1	26.00
" 2	26.00
" 3	26.00
" 4 Sunday	
" 5	26.00
" 6	26.00

Average week ending	
June 25	23.50
July 2	23.50
" 9	26.00
" 16	26.00
" 23	26.00
" 30	26.00
Aug. 6	26.00

Monthly averages

	1916	1917	1918
Jan.	24.30	29.53	23.50
Feb.	26.62	34.57	23.50
Mch.	26.65	36.00	23.50
Apr.	28.02	33.16	23.50
May	29.02	31.69	23.50
June	27.47	32.57	23.50
July	25.66	29.67	26.00
Aug.	27.03	27.42	....
Sept.	28.28	25.11	....
Oct.	28.50	23.50	....
Nov.	31.95	23.50	....
Dec.	32.89	23.50	....

Copper production of 21 of the leading mines in North and South America, accounting for 90% of the total output, yielded 960,640,659 lb. in the first half of 1918, a decline of 27,000,000 lb. when compared with this period of 1917.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date	
July 31	8.05
Aug. 1	8.05
" 2	8.05
" 3	8.05
" 4 Sunday	
" 5	8.05
" 6	8.05

Average week ending	
June 25	7.82
July 2	7.90
" 9	7.99
" 16	8.05
" 23	8.05
" 30	8.05
Aug. 6	8.05

Monthly averages

	1916	1917	1918
Jan.	6.95	7.64	6.85
Feb.	6.23	9.10	7.07
Mch.	7.26	10.07	7.26
Apr.	7.70	9.38	6.99
May	7.38	10.29	6.88
June	6.88	11.74	7.58
July	6.40	10.93	8.03
Aug.	6.28	10.75	....
Sept.	6.86	9.07	....
Oct.	7.02	6.97	....
Nov.	7.07	6.38	....
Dec.	7.55	6.49	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
July 31	8.37
Aug. 1	8.37
" 2	8.37
" 3	8.37
" 4 Sunday	
" 5	8.37
" 6	8.37

Average week ending	
June 25	8.18
July 2	8.78
" 9	8.85
" 16	8.78
" 23	8.08
" 30	8.45
Aug. 6	8.37

Monthly averages

	1916	1917	1918
Jan.	18.21	9.75	7.87
Feb.	19.99	10.45	7.97
Mch.	18.40	10.78	7.67
Apr.	18.62	10.20	7.04
May	16.01	9.41	7.29
June	12.85	9.63	7.92
July	9.90	8.98	8.72
Aug.	9.03	8.58	....
Sept.	9.18	8.33	....
Oct.	9.92	8.32	....
Nov.	11.81	7.76	....
Dec.	11.26	7.84	....

Spelter production and stocks, by grades, as far as available, are to be published each week by C. E. Siebenthal of the U. S. Geological Survey. Such statistics will enable smelters to so gauge their operations as to stabilize the market, and restrain consumers from erratic buying that disturbs the zinc market.

The report by C. E. Siebenthal on the spelter business last year is also to hand. Including small stocks and foreign ore, the available metal totaled 687,428 tons, just 5000 tons more than in 1916, but 177,000 tons greater than in 1915. The apparent consumption was 413,984 tons, a decrease of 44,000 tons. Stocks increased from 17,508 to 53,689 tons. On May 25, 1918, there was 49,798 tons on hand.

Production of secondary zinc in 1917, according to J. P. Dunlop of the U. S. Geological Survey, totaled 116,200 short tons. This was recovered from alloys, brass, dross, etc.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds:

Date	
July 9	120.00
" 16	120.00
" 23	120.00
" 30	120.00
Aug. 6	120.00

Monthly averages

	1916	1917	1918
Jan.	222.00	81.00	128.06
Feb.	295.00	126.25	118.00
Mch.	219.00	113.75	112.00
Apr.	141.60	114.50	115.00
May	90.00	104.00	110.00
June	74.70	85.50	112.00
July	81.20	102.00	120.00
Aug.	74.50	115.00	....
Sept.	75.00	112.00	....
Oct.	78.20	102.00	....
Nov.	79.50	102.50	....
Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918
Jan.	41.76	44.10	85.13
Feb.	42.60	51.47	85.00
Mch.	50.50	54.27	85.00
Apr.	51.49	55.63	88.53
May	49.10	63.21	100.01
June	42.07	61.93	91.00
July	38.37	62.60	93.00
Aug.	38.88	62.53	....
Sept.	36.66	61.54	....
Oct.	41.10	62.24	....
Nov.	44.12	74.18	....
Dec.	42.55	85.00	....

Eastern Metal Market

New York, July 31.

The markets are generally quiet. All the metals are strong except one, and two are very scarce.

Copper is now selling only at the price ruling at the time of delivery.

Tin is very quiet and very scarce. The market is unsettled.

Lead continues extremely hard to get with prices virtually fixed.

Zinc is quiet and lower.

Antimony is dull but fairly firm.

The quarterly statement of the U. S. Steel Corporation, issued yesterday, covering the second quarter, is striking testimony to the earning power of a great integrated producer on the present scale of Government-made prices. The net earnings of $62,500,000 in the second quarter, plus nearly $91,000,000 set aside for possible Federal war taxes, makes a total 70% greater than a similar total for the first quarter with its many shut-downs and poor output in January and February. A 10% wage-increase was also announced, which was a surprise to the independent producers. There have been five other 10% advances by the Corporation in the last 30 months and one of 15%, making the new wage 103% higher than that paid on January 1, 1916. A conference in New York on Monday, having to do with increasing the allotment of steel to shipyards, will be developed later this week into a Washington meeting where plans will be made to ensure shipyard work against interruption in the coming year. It was evident from the meeting held on Monday that, however detailed figures might be changed, the main fact was the increasing war-demand for steel, and with it an indefinite but inevitable reduction in the amount for other uses.

COPPER

The meeting next week, August 7, in Washington is almost the sole topic of conversation. One still hears confident talk of a 27.50c. price to be effective after August 15, to continue to January 1, after which 30c. per lb. is mentioned. No one, of course, knows what will result, since the War Industries Board is not divulging its attitude. Until this event is past the market is merely marking time, but it is strong. Where sales are made it is done only with the understanding that the price be the same as that ruling at the time of delivery. It is reported that the volume of business done is not large, especially for delivery before August 15, since the producers seem to prefer to wait, and perhaps to increase stocks. Consumers are, however, reported as well covered at least to August 15. The output of refined copper is now regarded as being at the rate of 210,000,000 lb. per month, which contrasts with 203,000,000 lb. per month in 1917. During the first five months of 1918 it was not over 190,000,000 lb. per month.

TIN

The tin market is the same old story—no business and no offerings. This is due, almost wholly now, to the new rulings referred to last week, which state that sellers in the Far East cannot do any business except under license from the Federated Malay States government. There has been no further explanation of this. Most importers and dealers do not know where they stand. A few lots have been offered and sold in the past week, but there was not more than a half dozen of them. Opinion is to the effect that this was done to test the new scheme. There is a pronounced scarcity of all grades of tin. For spot delivery in New York the quotation is still nominal at 94c. per lb. Buyers are not anxious and are apparently willing to let events take their course. Arrivals at Pacific ports continue large. For the month to July 27 they have been 5260 tons, with those at Atlantic ports 775 tons to July 24. The London market is again higher. Spot Straits is now higher than at any other time, or £385 per ton. A week ago it was £365 10s. per ton.

LEAD

There is no change in fundamental conditions. Very little business is reported and very little is possible, due to the continued scarcity of the metal. Another hindrance to transactions is the fact that the question of freight rates to other points than New York is still unsettled. The market is really nominal, but firm, at 7.75c., St. Louis, or 8.05c., New York. Spot metal is unobtainable, and practically none is available for August delivery. This refers to carload lots and larger. For less than carload lots, up to 8.75c. per lb., New York, has been obtained, but the understanding is that no metal is to be sold in carloads for any higher price than 8.05c., New York. Japan is said to be still in the market.

ZINC

Demand continued very light but a small amount of business is reported. The tendency downward, noted the past two weeks, has continued, and today the market is quoted at 8 to 8.12½c., St. Louis, or 8.25 to 8.37½c., New York, for prime Western for early and third-quarter delivery. At these levels the small transactions noted have been done. Fundamental conditions are regarded as strong. One beneficial result of the reactionary tendency is pointed out as the probable prevention of the resumption of production by some smelters who shut down when the market was much lower. A continued advance probably would have increased the output. As it is now, demand and supply seem to about balance. A feature is the issuing of weekly reports by the Government showing the output of various grades of zinc. Grade A, with a maximum price of 12c. per lb., is reported as having sold recently considerably below this. Sheet-zinc is fixed at a minimum of 15c. per lb. with plate-zinc at 14c. per pound.

ANTIMONY

For prompt and early delivery of 25-ton lots 13 to 13.25c., New York, duty paid, is the quotation, with the market quiet and dull. An interesting statement is to the effect that a duty of 7c. per lb. is being considered seriously as an incentive to production in this country. Imports have been large. For the 11 months ended May 31, 1918, the imports of metal and regulus were 38,148,949 lb., as against 22,604,460 lb. for the same 11 months in 1917.

ALUMINUM

Government maximum prices control the market for No. 1 virgin metal, 98 to 99% pure and for scrap. These are 33c. per lb. for 50-ton lots, 33.10c. per lb. for 15 to 50-ton lots, and 33.20c. per lb. for 1 to 15 tons.

ORES

Antimony: No business is reported, quotations remaining unchanged and nominal.

Molybdenum: The nominal quotation continues about $1 per lb. of MoS_2 in 90% material, with very little demand.

Tungsten: The market is firm at $20 to $24 per unit for 60% concentrates, with the higher grades commanding $24 to $24.50. A fairly active market for the past week is reported. Ferro-tungsten is quiet, and largely nominal, at $2.40 per lb. of contained tungsten.

INFORMATION FURNISHED BY MANUFACTURERS

The B. F. Goodrich Rubber Co., in a recent circular, affirms that when humanitarian principles govern the relations between employer and employee, the utmost efficiency of man-power is obtained. It is the tonic for creative force. In a prize essay by L. M. Barton he says: "One of the most humane, and therefore one of the best employers in America, is my own, the B. F. Goodrich Company. Of its army of 22,000 workers almost 20,000 are employed in the company's big Akron, Ohio, factories. The remainder are in 125 big cities. The company occupies a high place in the rubber industry. Our big factories work 24 hours every day for six days of the week. Three shifts keep the crude rubber going in at one end and the finished products coming out at the other. Each shift works eight hours per day. Saturday night at 11 o'clock the factories close and do not re-open until midnight Sunday. The Goodrich company believes that the best employee is the man who is as free from worry as it is humanly possible to make him. Three months from the date when he begins to work each employee receives gratis, a life insurance policy for $500, in favor of any beneficiary he may designate. This policy is increased $100 each year until it reaches $1000. Literally speaking, almost as soon as a man begins to work for Goodrich, he is worth $500 more to his dependents than he was before. Employees' policies are covered by a group-plan life insurance, placed with the Equitable Life Assurance Society. When the legislature of the State of Ohio enacted its workingmen's compensation law a few years ago, it used as a basis the idea contained in this Goodrich plan, adopted more than 20 years previously. If injured during work, the company supplies all necessary facilities and pays for medical or surgical attention. If injured anywhere during unemployed time an employee receives the same compensation. In no instance is the employee required to contribute to this insurance. Compensation for an unmarried man amounts to one-half of his average weekly wage or salary, but if married, or contributing regularly to dependents, he receives two-thirds. This applies to women as well as to men. The Goodrich company realizes that it is often necessary to employ married women for some classes of work and in such cases pays disability compensation for 8 weeks preceding and for 13 weeks following the birth of a child. The only provision is that a woman must have been in the employ of the company for the preceding 12 months. In addition to these features those men and women who have served the company faithfully are retired and pensioned when they reach the ages of 70 and 65 years, respectively, regardless of the number of years they have served the company. These pensions vary according to the number of years of service, but none are less than $20 per month, and none exceed $100 per month. The personal safety is ensured by modern safety devices throughout the plants. This system is so perfect and accidents are otherwise so well guarded against that a fatal accident is rare. Not one occurred during the entire year 1917. In social and educational matters the Goodrich company is doing more than any employer I know of. The company maintains a free school under capable instructors. In it are enrolled 1240 pupils, ranging from 18 to 50 years. Here men and women of 30 nationalities are taught English, arithmetic, writing, history, civics, mechanical drawing, spelling, physiology, commercial geography, French, Spanish, and Russian. Within the past 10 months alone 150 foreign-born students have become American citizens, and a total of 450 have become naturalized. For its girl employees the Goodrich company several years ago acquired a tract of 44 acres of land bordering a small lake within a few miles of the city, and established a clubhouse and recreation park. The cost of these things is justified by the results that are obtained. If people are to be efficient and loyal workers they must be happy, and the cost of this happiness comes back to the company in the form of better goods for its customers."

The Case Manufacturing Corporation, a concern with closely held stock, has just organized for business at Denver. It will manufacture oil-burners, oil-furnaces, and kindred apparatus. The Case oil-burner is well known, having been in general use among assayers for many years, and has an established reputation for reliability and economy. The late W. W. Case, the inventor of the oil-burner that bears his name, had specialized on oil-furnaces, and the Case Manufacturing Co. will make a full line of this equipment, such as oil-fired tilting crucible furnaces, muffle and roasting furnaces, as well as oil-fired furnaces adapted for the heat-treatment of various metals and for heating steel for forging. The active men in the organization are Fred McL. Strout, vice-president and traveling representative; Theodore W. Muckle, treasurer and factory manager; and Seth Parlin, secretary. In addition to the appliances mentioned above, the concern will deal in metallurgical clay goods, and apparatus for assayers, metallurgists, and chemists. The staff includes experienced engineers and metallurgists who will be glad to advise customers of the house in regard to furnace equipment for specific purposes.

The Wellman-Seaver-Morgan Co., of Cleveland, Ohio, has issued a bulletin on coke-oven machinery. It gives representations of the latest practice, such as the combined coke pusher and coal-leveler as used in the Semet-Solvay by-product ovens in its great plants at Detroit, Buffalo, Cleveland, Syracuse, and other points. These appliances are also used by the Bethlehem Steel Co., National Tube Co., Youngstown Sheet & Tube Co., and all the leading makers of by-product coke. Each machine is capable of serving 100 ovens. They are very simple in construction, considering the various functions they have to perform. The bulletin also shows accessory equipment for coke-oven operation, such as door-lifters, coal-charging larries, and door-extractors.

The Chicago Pneumatic Tool Co. announces the appointment of L. C. Sprague as special representative in connection with the sale of pneumatic tools to railroads. Mr. Sprague was formerly connected with this company, but more recently has been with the railroad department of the H. W. Johns-Manville Co., New York.

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Edited by T. A. RICKARD

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AN INDEPENDENT PAPER OWNED EDITED, AND MANAGED BY ENGINEERS

REMCO

WE FURNISHED THE

UNITED STATES GOVERNMENT

1,705,429 FEET REMCO PIPE

Camp	Feet	Camp	Feet	Camp	Feet	Camp	Feet
Camp Devens, Mass.	85,227	Ellington Field, Texas	21,439	Coastal Aero Station, Fla.	1,000	Camp Sevier, S. C.	4,008
Camp Taylor, Ky.	17,803	Gerstner Field, La.	21,447	Ebbetts Field, Ark.	9,801	Camp Travis, Texas	11,753
Camp Jackson, S. C.	73,884	Embarkation Camp, Va.	16,015	Ordnance Depot, Md.	7,160	Camp Jones, Ariz.	7,808
Div. N. J.	134,340	Camp Talaferro, Texas	11,642	Camp Humphreys, Va.	8,000	Camp Shelby, Miss.	28,000
Camp Pike, Ark.	59,283	Camp Meade, Md.	16,744	Mills Field, Cal.	9,925	Camp Sheridan, Ala.	25,904
Camp Dodge, Iowa	95,084	Camp Johnston, Fla.	56,232	March Field, Cal.	10,656	Camp Wadsworth, S. C.	54,484
Camp Gordon, Ga.	13,128	Engineer Depot, France	189,411	Explosives Plant, W. Va.	18,500	Camp Lee, Va.	3,601
Camp Fremont, Cal.	68,308	Camp Stuart, Va.	71,203	Quartermasters' Terminals, S. C.	58,355	Norfolk Q. M. Terminals, Va.	10,138
Camp Kearny, Cal.	61,616	Love Field, Texas	13,807	Army Camp, Texas	6,302	Camp Logan, Texas	22,600
Camp Merritt, N. J.	22,920	Raritan River Ord. Dep., N. J.	16,954	Camp Eustis, Va.	65,035	Camp McArthur, Texas	23,000
Camp Custer, Mich.	7,604	Kelley Fields, Texas	94,697	Navy Yard Vallejo Cal.	9,000	Camp McClellan, Ala.	28,400
Camp Cody, N. M.	16,610	Brooks Field, Texas	4,212	Marine Training Camp, Va.	20,955	Q. M. Corps, Construction Div.	198,100
Camp Wheeler, Ga.	9,691	Pig Point Ord. Dep., Va.	4,634	Camp Perry, Ohio	15,913		

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Camp	Gallons	Camp	Gallons	Camp	Gallons	Camp	Gallons
Camp Devens, Mass.	400,000	Camp Johnston, Fla.	400,000	Gen. Hospital No. 3, N. J.	200,000	Q.M. Dep., S.Schenectady, N.Y.	400,000
Camp Taylor, Ky.	1,000,000	Ellington Field, Texas	60,000	Fort McPherson, Ga.	200,000	Q.M. Dep., E. Columbus, Ohio.	400,000
Camp Upton, N. Y.	850,000	Engineer Depot, France	387,500	Mechanical Repair Shop, Md.	200,000	Q.M. Dep., New Cumb., Pa.	400,000
Camp Meade, Md.	400,000	Love Field, Texas	275,000	Tuberculosis Hospital, N. Y.	420,000	Ordnance Depot, Pa.	200,000
Camp Pike, Ark.	1,200,000	Fort Caswell, N. C.	200,000	Chemical Plant No. 4, Va.	649,000	Marine Training Camp, Va.	1,256,000
Camp Sherman, Ohio	400,000	Pig Point Ord. Dep., Va.	230,000	Park Field, Tenn.	100,000	Filtration Units, France	1,251,200
Camp Gordon, Ga.	1,000,000	Kelley Field No. 1, Texas	100,000	Navy Yard, Pauillac, France.	100,000	Aviation Concentration & Supply Depot, L. I.	100,000
Camp Funston, Kan.	800,000	Dorr Field No. 2, Fla.	200,000	U.S. Explosives Plant, Tenn.	1,054,300	Camp Perry, Ohio	300,000
Camp Custer, Mich.	400,000	Ebbetts Field, Ark.	100,000	Queenstown, Ireland	100,000	Aerial Gunnery School, Fla.	200,000
Camp Wadsworth, S. C.	700,000	Taylor Field, Ala.	100,000	Guantanamo, Cuba	47,000	Camp Jones, Ariz.	100,000
Camp Wheeler, Ga.	500,000	Ordnance Depot, Md.	899,000	Payne Field, Miss.	100,000	Q. M. Term., Charleston, S. C.	400,000
Camp Cody, N. M.	300,000	Mt Clemens, Mich.	120,000	Souther Field, Ga.	100,000	Raritan River Ord. Dep., N. J.	50,000
Camp Sevier, S. C.	400,000	Camp Talaferro Fields, Texas		Clearing Hospital, N. Y.	200,000	Coast Defense, Pensacola, Fla.	400,000
Camp Shelby, Miss.	400,000	No. 1, No. 2, No. 3.	300,000	Mills Field, Cal.	175,000	Final Testing Field, Dayton, O.	100,000
Camp McArthur, Texas	200,000	Fort McHenry, Md.	200,000	March Field, Cal.	75,000	Q. M. Corps, Construction Div.	8,000,000
Camp Greene, N. C.	400,000	Coastal Aero Sta. Fla.	101,000	U.S. Explosive Plant, W. Va.	600,000		
Camp Logan, Texas	400,000	Call Field, Tex.	100,000	U.S. Hospital, N. C.	300,000		
Camp Stuart, Va.	1,600,000	Camp San Juan, Porto Rico.	400,000	Camp Eustis, Va.	600,000		

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The Duty of the Employer to the Crippled Soldier

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COURTENAY DE KALB, Associate Editor
M. W. von BERNEWITZ, Assistant Editor

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BUSINESS STAFF:

C. T. HUTCHINSON, Manager
E. H. LESLIE, 600 Fisher Bdg., Chicago
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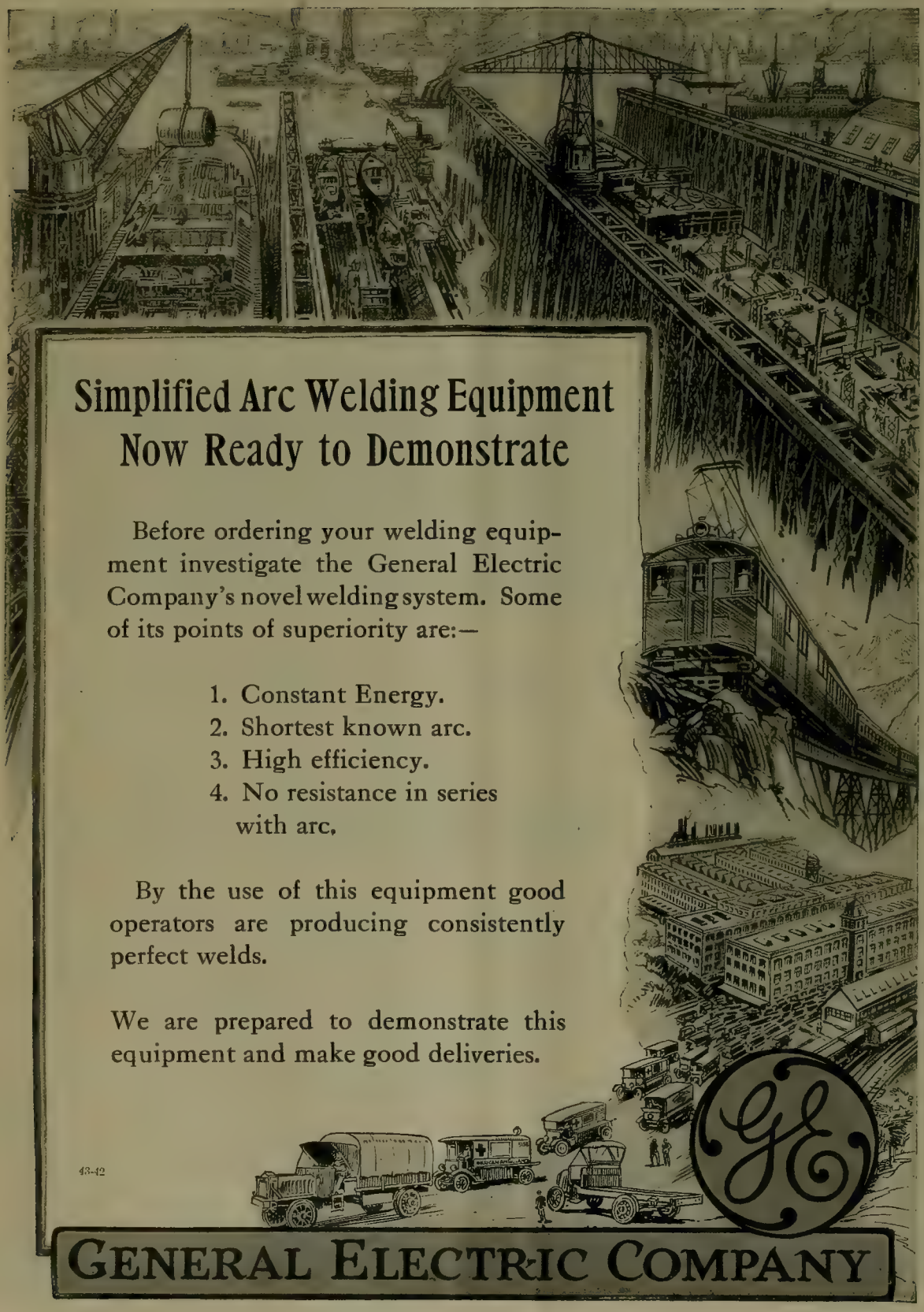

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GENERAL ELECTRIC COMPANY

THE Federal Trade Commission now issues a summary of complaints made to it and of orders made by it. This is a useful kind of publicity, for it places wrong-doers in the pillory of public opinion.

SMALL producers of quicksilver are complaining of the delay in payment on shipments. The Navy department, as agent for the Government, is buying 40% of the output at $105 per flask. Deliveries made in April and May are said to be awaiting settlement.

A CONFERENCE to discuss "the gold stringency" is to be held at Spokane on September 2 and the five days following under the auspices of the Northwest Mining Association. A committee consisting of Messrs. F. A. Ross, A. W. Boyd, F. C. Bailey, and S. Norman will arrange details.

NOBODY should have been surprised that the War Industries Board decided to enforce economy in the use of paper; on the contrary, it is surprising that this measure of disciplinary reform was so belated. No waste is more obvious than the waste of paper by our newspapers, particularly in the Sunday supplements, with their mass of piffle and misinformation. We are thinking, of course, of our local papers, not of the New York 'Times,' Boston 'Transcript,' or other newspapers of the first class.

AMONG the articles listed by the Department of State for export to Mexico, in addition to certain foods, are all kinds of mining machinery, tools, manufactures of iron, steel, copper, and zinc, cyanide, dynamite, caps, and fuse. This order was issued at the request of President Wilson as an evidence of goodwill toward our neighbor on the South. We understand, nevertheless, that difficulty is experienced in some parts of Mexico in securing the necessary co-operation of local officials in obtaining permits to import explosives into the country.

CHARLES SCHWAB may lack the refinement that we consider as much the prerogative of a democrat as of an aristocrat, but his driving power and executive ability are qualities fitting him peculiarly for his great work as director-general of shipping. He knows how to appeal to the workers, as is shown by a photograph in which he stands smiling with his arms around the shoulder of Mr. Bert Myre, the champion rivet-driver of the Pacific Coast. The picture expresses the solidarity of a democratic people in a manner to gladden the heart of all good citizens.

COMPLAINTS reach us regarding payments made on copper ore shipped to smelters by small producers. For instance, on July 20, the American Smelting & Refining Co., when returning a number of settlement-sheets, wrote as follows to the El Tiro Copper Company at Silverbell, Arizona: "You will note that we are settling this lot based on 23½ c. copper, as we have no official advice from the Government of an increase; however, adjustment will be made later according to Government advice." The agreement to raise the price to 26 cents was made on July 2, eighteen days before the date of this note. The smelting company's headquarters at New York must have been informed within an hour. The refusal to settle on the new price is justifiable legally, but it looks like a technicality, likely to irritate, as it did. On July 2 the same company had nearly 100,000 pounds of copper, some of it unsampled, at the smelter. On this the smelting company paid at the old (and lower) rate, claiming that its date of settlement is the day on which the ore is received and not the day on which payment becomes due. This is the sort of thing, of course, that causes a sentiment of dislike against the powerful smelting combination. It is to be brought before the Federal Trade Commission, and we hope that the result will be the establishment of a basis for settlement fair to all concerned.

QUOTATIONS for chrome ore have been weak and erratic, causing anxiety in California, where the exploitation of deposits of this mineral has attracted much interest recently. We are informed by the Committee on Geology and Mineral Resources of the State Council of Defense that there has been an attempt to discount the established price, accompanied by rumors that the market would be affected by importation from Cuba, and that steel-makers had decided to replace chrome with manganese. There is good reason to believe that the depression in the chrome market is artificial and temporary. The Committee anticipates no reason for a decrease of consumption or for a curtailment of production, and all producers are advised to continue active develop-

ment. It is unfortunate that members of the U. S. Tariff Commission recently in San Francisco, to afford hearings on the status of tungsten, quicksilver, and antimony, did not make a similar inquiry into the chrome industry. The vagaries of the market and the apparent attempts to manipulate prices indicate the urgent need for the establishment of a Minerals Administration able to exercise salutary supervision.

WE note with pleasure that Secretary Lane has written a letter to the chairman of the Ways and Means Committee of the House of Representatives deprecating "the effect of the excess-profits taxes on the production of certain minerals essential for carrying on the War" and suggesting care in assessing taxes so as not to kill these industries. He mentions "the fact that new mining enterprises of uncertain life are not allowed to amortize the actual investment before becoming subject to the excess-profit tax." This is due to the custom of regarding dividends from mines as income, whereas, as a matter of fact, most of them represent the return of capital. It is only when the mine has redeemed its capital that its dividends are real profit on the 'investment,' or speculation, as we prefer to call it. A mine is a wasting asset and until the yield from it has more than amortized the money sunk in the enterprise it is not a profitable venture, except for those that meanwhile use the stock as a counter for a gamble, selling it for more than they paid for it and for more usually than it is worth.

UPON another page we publish an article on the duty of the employer to the crippled soldier. It is well that the public should face this obligation now that the casualty lists are making us realize the sacrifice offered for our country by the brave fighters at the front. Congress has taken the matter in hand, delegating to the Federal Board for Vocational Education the great task of rehabilitating our wounded soldiers and sailors. Experience in Europe has shown that over 80% of the permanently disabled men can be trained for useful, self-sustaining, and wage-earning employment, rendering them serviceable not only to release able-bodied men for the front, but also for the great work of civil readjustment that must follow the cessation of hostilities. Such training will preserve the self-respect of men whom we respect greatly. In the article by Mr. Douglas C. McMurtrie, this purpose is explained on behalf of the Red Cross Institute for Crippled and Disabled Men, in New York. The managers of mines and mills should be prepared to assist, since at any large mine or mill there are jobs particularly suitable for honest and reliable men that are incapable of active movement, such as watchmen, switch-tenders, samplers, book-keepers, warehouse clerks, and weighers. This work should be of immediate interest to every citizen; to vote pensions is not nearly so helpful as to assist a man to be independent; we must see to it that our champions returning battered from the conflict are not reduced to semi-mendicancy or to unhappy idleness; in short, those who have not been privileged to bear arms for their country must do an act of justice to the men that have borne the brunt of the fray.

IT will be interesting to see what effect may be produced in Mexico by the announcement that Carranza proposes to offer himself for a second presidential term. When gentlemen in the Latin countries ride into office on the wings of a revolution there is no equation known for finding the *n*th term. That is a fertile excuse for fresh revolts. Carranza triumphed on a revolutionary program the chief planks of which were the vindication of the constitution of 1857 and the principle of no re-election. We have seen the constitution swept aside by a radical document, socialistic in its provisions, with loop-holes that admit of maintaining an actual autocracy; now the doctrine of succession is about to be violated. News of the persistent activity of revolutionary bands leaks across the border at intervals, but it is not generally realized that these pertain to a fairly well organized movement of which Felix Diaz is the acknowledged head. The uprising in Nuevo Leon under Eduardo Martinez and that of Juan Cabral in Sonora both are connected with the Felicista party. Martinez is a lawyer of ability and good reputation; Cabral distinguished himself as a general in the previous Constitutional struggle, and is favorably known in this country as a graduate from an American university. It is a pity that Carranza should not make it easy for such men, possessed of personal bravery and intellectual strength, to take an honorable part in the reconstruction of the country. Our Government is endeavoring to help the administration in Mexico to work out its problems, and one of these is to re-establish the guarantees of civic liberty, so as to make revolution more difficult and wholly reprehensible. It is an error to regard Mexicans as predisposed to military uprisings. Those who know them best are aware of the fact that they are a singularly litigious people, and the tendency to carry their grievances into court argues an inherent respect for law. On such a national characteristic it should be possible to build a solid civic structure, and to put an end to internal strife. First, however, confidence in the administration must be created, and this cannot be done by breaking promises.

ELECTROLYTIC zinc is of higher grade than the redistilled, and at an equal price it is preferable. The War has resulted in establishing some new standards, and the manufacturers of brass have had the desirability of high-grade spelter forced upon their attention. Consequently it is anticipated that they will continue to demand it in preference to 'brass special,' and that the price of 'prime Western' will be regulated by the higher grades as the production of these increases. The requirements of the Government are for zinc containing not more than one-tenth of 1% of impurities, with narrow limits fixed for the lead, iron, and cadmium, and it appears that many distillers are able to meet these specifi-

cations. Outside the particular market for military uses a premium can be obtained for electrolytic zinc. A considerable demand exists for an exceptionally pure metal in the chemical industry and in the manufacture of ornamental and of some special bronzes. Also the makers of manganese-bronze are willing to pay a higher price. A considerable future for electrolytic zinc is seen in the development of zinc wire, zinc tubing, and other new applications of the metal that the extreme purity of this product renders possible. The present opportunity for the zinc-producers is to take advantage of the extraordinary consumption of the other metals for munitions to enter industrial fields thus vacated temporarily and to demonstrate the fitness of spelter to persist as a competitor in these uses after the War. Nothing is more valuable for any industry than to face circumstances that stimulate ingenuity, and this chance to substitute the cheaper metal for those that are always more costly may prove in the end a greater boon than the absorption of larger quantities for a brief period at better prices. The effect of the huge demand in 1915 was reflected in the increase of smelting capacity from 115,114 retorts at the close of 1914 to 218,000 at the present time. Under the spur of exorbitant prices the furnace capacity of the country grew 14% in the first six months of 1915. Today 40% of the retorts are idle. The fact that Australian zinc concentrate was smelted largely in countries dominated by the Germans after the invasion of Belgium, played into the hands of American producers, but Australia has again entered the lists and the smelting of the product will continue under British control in future. Accordingly, the response made in providing additional plant under the stimulus of war at the beginning has left the Americans in a position to take advantage of every opening for selling high-grade zinc, and to encourage its use in place of the lower grades at prices commensurate with the advantage it offers the consumer. Thus a large part of the excess smelting capacity eventually may be utilized advantageously. There has never been a more favorable set of circumstances for expanding the application of zinc, and such efforts as are being made by offering prizes to promote invention with that object in view will tend to convert the momentary difficulties into a permanent improvement of the status of zinc mining.

The Account

The casualty lists are lengthening; daily we are becoming more proudly conscious of the part that our country is taking in the great contest overseas; it is brought home to us not only by the splendid record being made by our Army but by the loss of those dear to us. Even among those least sensitive to the calamity that has darkened the world for four long years, even among those curiously detached persons to whom the war in Europe has been chiefly a tremendous spectacle, even to the selfish and the callous, the grim reality of events is being visualized by the list of names on the roll of honor. Every one of us now has been awakened to a realization of the cost, not in money, ships, or guns, but in warm human blood, and that realization has stirred our feelings as never before. To the intelligent, such as the members of the mining profession, the keen interest in events has been deepened by sorrow, as friends and relatives have made the supreme sacrifice. Such sorrow has given way to another feeling, one of anger that the flower of our youth, the pick of our race, should be sacrificed to the criminal aggression of the Prussian, the beast with the brains of an engineer, who provoked the suicide of civilization under guise of a campaign for his vaunted 'kultur,' the creed of a thinly veneered barbarism that disregards every law of God and man. We did not start this thing; we kept out of it until patience ceased to be a virtue; we went into the war to prevent the wrecking of civilization, to throw our strength on the side of the oppressed, on the side of right, against the great military machine that threatened to put all nations of the earth under its savage heel. Our loss will not weaken our purpose, but, as we learn of the death of those we love, we lift a clenched fist and call to account the men responsible for this carnage. The story is told that a blacksmith on the Scottish border had a young assistant named Jock, who volunteered for active service promptly. A few months later a friend came to the blacksmith and said: "D'ye ken that Jock's been kilt?" To which the other replied: "Aye, mon, he's been kilt!" The burly blacksmith tore his apron off and with clenched fist exclaimed: "Then somebody will have to accoont to me for thaat!" Does not this story express our feelings today? We are fighting to keep the world safe for democracy and for the right to live in our own way, free from the hectoring of a military caste without the sense of honor, but are we not fighting also to bring somebody to account? Is not our sense of justice outraged? Shall the murderer go free and the pirate pass unpunished? No! The memory of the brave and the innocent makes an appeal more thunderous than the howitzers. There must be an accounting for this ineffable crime. We know who is responsible. The doubts of the judicious have been swept aside by evidence so damning that rebuttal is impossible. The memorandum by Lichnowsky, Germany's ambassador at London, has given away a case that was black enough on the circumstantial evidence four years ago. The confessions of Mühlon, the Krupp director, of Thyssen, the steel manufacturer, and the statements made by Wangenheim, the German ambassador at Constantinople, to Mr. Morgenthau, our representative at the Porte, are in the testimony recently made public. All of it proves beyond the shadow of doubt that this war was the immediate result of a conspiracy between the autocratic governments of Austria and Germany, and that Germany pushed Austria into the opening fight in order to carry out a scheme of conquest carefully devised, the sequel to forty years of preparation, by means of a propaganda to which the German people proved receptive in the hope of national aggrandizement and economic gain. The Hohenzollerns and the Hapsburgs, with their military castes,

impressed their will on peoples debauched by the hope of political and commercial gain, using them as pitiable tools for their astounding crime. The assize of history will not hesitate to convict the instigators and perpetrators of this bloody offence. The paranoiac Kaiser and the successor to his wretched old partner at Vienna, their crafty chancellors and their unscrupulous chiefs of staff, each is known by name, and each must be brought to account. When that time comes, for which the armies of the Allies are now fighting unceasingly, their dupes, the peoples of Germany and Austria, will be arraigned also as *participes criminis*. They cannot be punished individually; it is not necessary that they should be, for their own deeds are their doomsmen, they are destined to drink the dregs of sorrow and the bitterness of defeat; they will bear a burden for generations to come. They will be punished sufficiently; but if justice is to be held in honor on the earth, let us see to it that the principals are brought to personal account and punished to the uttermost, so that they will be unable to commit a similar crime again and so that no other men like-minded will ever dare to imitate their vile example.

Food Administration

Members of the mining profession have taken a keen interest in the effort to conserve and regulate the supply of food for the use of our own people and for that of our Allies; they have been keenly interested not only as good citizens but on account of their goodwill to the Food Administration. Mr. Hoover has awakened the most friendly feelings from all of us, because he is a mining engineer of extraordinary executive ability and because he did such a splendid thing in organizing the Commission for the Relief of Belgium. He abandoned a highly lucrative profession and business, as engineer and financier, in order to throw himself with all his heart and strength into a systematic effort to aid the first victims of German brutality, the gallant defenders that held the bridge against the oncoming swarm of gray despoilers. We admired him for that and for the immediate success that he achieved in feeding the starving Belgians, particularly the children. A typical American democrat, he met the big men of Europe and held his own with them in a contest of wits and resourcefulness. We liked that. Therefore it seemed good to us, of the mining profession, that he should be selected by the President as the head of a Food Administration for the United States. Again he has made good, and we rejoice that he should have done so unmistakably. No branch of the Government during the period of this war has been as cordially supported by the public as the Food Administration. From the first, Mr. Hoover appealed to the sense of honor, to the loyalty, to the unselfishness of the ordinary citizen. His confidence in the mass of the people has been justified to the hilt. The requests, regulations, and edicts of the Food Administration have been received not only with docile compliance but with enthusiastic co-operation. The results are eloquent. Early in 1917 the Food Controllers of our Allies asked for an additional 75,000,000 bushels of wheat; we shipped to Europe nearly 85,000,000 bushels before the close of the fiscal year. At the time they asked for this aid our own surplus was more than exhausted; the year before we had exported the surplus of 200,000,000 bushels to our Allies; in 1917 there was only enough for our normal consumption; therefore the shipments to Europe represented the savings from our own wheat-bread. Despite a much increased average of corn-land in 1917, the crop of corn was below the average. "The total nutritional production of the country for the fiscal year was between 7 and 9% below the average of the three previous years, our nutritional surplus for export in these years being about the same amount as the shrinkage last year." So says Mr. Hoover himself. This shows how greatly the consumption and wastage of food must have been reduced. In meats and fats the United States, in the fiscal year ending June 30, 1918, sent to the Allies 844,600,000 pounds more than in the year previous. The following figures speak for themselves; they represent exports to Allied destinations in the year ending June 30, 1918, and in the year ending June 30, 1914:

	1918	1914
Beef, pounds	522,291,807	33,225,111
Bacon, pounds	815,319,424	193,964,252
Condensed milk, pounds	529,750,032	16,209,082
Flour, barrels	21,880,151	11,821,461
Grain, bushels	219,472,813	112,500,360
Ham, pounds	419,571,869	165,881,791
Value	$1,055,955,820	$210,509,180

In May and June the foodstuffs cited above represented exactly one-third the value of all our exports, whereas in 1914 they represented only 9% of the total. About 85% of our recent exports of flour have gone to England, France, and Italy, as against 24% in peace times; of our meats, 80% has gone thither, as against 16% formerly. These increases represent the feeding of our Allies and of our own army and navy in Europe. In his recent speech at the Mansion House, in London, Mr. Hoover said, "We are sitting at a common table." The Big Brother has shared his heaping plate-full with the other members of the family, including the Mother Country with whom he had a quarrel once upon a time. Nothing has so testified to the disinterested spirit of the United States in entering the War as this willingness to share food, without any question of profit arising. The greater sacrifice of life for the Cause is now being made with equal wholeheartedness. We sit not only at a common table but we stand reverently at a common grave, and from the sharing of this common experience shall come an understanding and a sympathy with England, and with France and Italy, such as shall cement the nations into a league for peace more effectively than any agreement on paper. When the historian looks back upon these calamitous years he will recognize the far-reaching effect of the international benefaction with which Mr. Hoover has been identified and he will appreciate the enormous advance in social feeling engendered by the national and international sharing of food, as carried out under his effective administration. Not all the victories of war are on the battlefield.

The Status of Gold Mining

The Editor:

Sir—In your issue of July 27, under the heading 'The Menace to Gold Mining' there was published a statement to the effect that the California Metal Producers Association had endorsed the plan for paying a bonus of $10 per ounce as a minimum in addition to the regular rate of $20.67 upon gold produced in the United States.

This statement I believe to be erroneous, as no action was taken by the Association on this question except at a meeting of the executive committee which was held on July 24. At that time the whole subject was discussed and the committee was unanimous in its opinion that it would not be of permanent benefit to the gold-mining industry of California to advocate the payment of such a bonus. Suggestions for principles which should govern the taxation of gold mines were approved by the executive committee and our representatives in Congress have been asked to favor them, as follows:

"In any mine taxation, account must be taken of the following points:

1st. As regards gold mines, there is and can be no excess profit in gold mining as a result of the War, since the price of the output is fixed, while the price of supplies and labor has risen. As a matter of fact, profits in gold mining have decreased as a result of the War.

2nd. With regard to all mining, including that of gold: Account must be taken of the fact that a mine is a wasting asset. Each year as ore is taken out the total amount available is decreased by that much. Each mine has a fixed life. The nominal return for a year is therefore, in fact, largely a return of the principal involved in the operation until the total of such returns serve to extinguish said principal. Any just system of taxation must therefore take into account and allow for an adequate depletion charge to cover exhaustion of gold reserves.

3rd. Not every prospect makes a mine, and in order to keep development of mines going, it is necessary to spend money on prospects, many of which yield no return. In order, therefore, to keep development going, it is necessary that the mine which does prove profitable shall pay a sufficient return to allow for writing off the unprofitable work. The 8% return allowed by the present law as an average for all industries is not sufficiently large to do this. It is probable that other industries have similar problems and to secure justice the fixing of the return for each industry, or club of industries, should be a matter of expert determination. No single rate for all industries in America can be a just or fair rate.

4th. Mining men have no disposition to avoid fair taxation, and for the period of the War will willingly submit to any taxation of true excess profits that Congress may consider necessary. It is important though that only the real excess profits should be determined. The British system of measuring such excess by the returns of the current year against the average for the period of 3 years preceding the War is defective, in that this does not take into account new producers which were not being called into being by the War. As an example, a gold-dredging company may be cited. Such a company may have worked several years drilling its ground and building its machinery with no return. It has happened that a number of such companies have only come into production since the War started. Under the British system any return which they now make is an excess return. As has already been shown, this is not true and in fact may really represent a returned principal which may never amount to the total involved in the enterprise."

The above suggestions were not original with any member of the executive committee, but were those which had been advocated by officials of the Bureau of Mines and under the circumstances seemed so fair that their adoption is urged by the California Metal Producers Association as a partial relief to the ills from which gold mining now suffers. On the other hand, it was felt that the payment of a bonus at this time, even if such payment could be obtained, would result in great damage to the business, when the time should come for the inevitable readjustment to normal conditions. Furthermore, it was felt that such a step would simply produce a new crop of irresponsible promoters who would extract rich toll from the pockets of the public without adding materially to the production of gold.

ALBERT BURCH,
President,
California Metal Producers Association.

San Francisco, August 3.

The Market-Value of Gold

The Editor:

Sir—In the letter headed 'The Relation of Gold to War Finance,' which appeared in your issue of August 3, Mr. B. L. Thane states: "The price of pure gold in our standard of money is fixed at $20.67 per ounce. This value was arbitrarily fixed by the Bank of England when England decided that it was advisable to fix the value of gold in order to stabilize exchange."

Although it is quite probable that the British government was influenced by the advice or suggestion of the Bank of England when it (the British government) enacted the law which requires that twenty pounds Troy weight of standard gold (eleven-twelfths fine) shall be coined into 934½ parts, or pieces, each of which is called a 'sovereign' or 'pound sterling,' that Act simply de-

termined that gold should be the standard of value and that the weight of the unit of value should be 123.2744+ grains of said standard (115,200 gr. ÷ 934½), but it in no wise determined the worth or purchasing power of that quantity of gold. The British government decided "arbitrarily" only that a certain weight of a particular commodity should constitute its unit of value. The worth or purchasing power of such unit cannot be decided "arbitrarily" because such worth is determined solely by the exigencies of trade and commerce.

An ounce Troy (480 gr.) of British standard gold divided by 123.2744+ gr. (the number of grains of standard gold in a sovereign) gives a quotient of 3.893+. Reducing the fraction to shillings and pence, we obtain £3 17s.10½d.; hence the 'price' of British standard gold is said to be three pounds seventeen shillings ten pence half-penny per ounce. There are 113.0016+ gr. of pure gold in a sovereign, and an ounce divided by this number of grains gives a quotient of £4 4s.11.45d., therefore the 'price,' in British money, of an ounce of fine gold is four pounds four shillings eleven and 45-hundredths pence or, as stated by Sir Lionel Phillips, "roughly 85s. per oz." ('The Importance of Gold Production,' M. & S. P., August 3, 1918.)

Similarly, our Government decided "arbitrarily" that 25.8 gr. of standard gold (nine-tenths fine) or 23.22 gr. of fine gold should be its unit of value; but that enactment neither "arbitrarily" nor otherwise determined the worth or purchasing power of that quantity of gold, because, as is the case with the sovereign, the exigencies of trade and commerce determine the worth or purchasing power of the amount of gold in a U. S. dollar.

By dividing an ounce (480 gr.) by 23.22 gr. the quotient is 20.67183+; therefore, in terms of the U. S. unit of value, the 'price' of gold is said to be 20.67183+ dollars per ounce, but, whether one says the 'price' of fine gold is "roughly 85 shillings per oz." or $20.67 per oz., its worth, exchange value or purchasing power is only what one can get for it when it is traded or bartered or swapped for something else.

As is stated in my letter entitled 'What is a Dollar?' (M. & S. P., Aug. 3, 1918), the word 'price' is used particularly to express the worth of anything in terms of a unit of value, but, because all values are relative, it is impracticable to express the value of anything in terms of itself. For example, it conveys no idea of value to say a ton of coal is worth twenty hundred-weight of coal. Similarly it should convey no idea of value to say an ounce of gold is worth 20.67+ times 23.22 gr. of gold; but that is literally what is meant when one says the 'price' of gold is $20.67+ per ounce or "roughly 85 shillings per ounce." To appreciate this fact fully one must disposses one's mind for the moment of one's idea of the exchange value of 'dollars' and 'shillings.'

Again, Mr. Thane states that "in the $20 gold-piece as now issued there is not quite an ounce of pure gold, the difference between $20 and the $20.67 consisting of copper added for the purpose of making the coin harder and more serviceable." It seems difficult to understand precisely what is meant by this. But, as a matter of general information, it may be stated that the $20 gold-piece weighs 516 gr. (20 times 25.8 gr.) of which nine-tenths or 464.4 gr. (20 times 23.22 gr.) is pure gold and 51.6 gr. is copper. At its present price, 26c. or 6.0372 gr. of gold per lb., the copper in a $20 gold-piece is worth 51.6/7000 of 6.0372 gr. of gold or 0.0445+ gr. and, as one cent is 0.2322 gr. of gold, the copper in a $20 piece is worth now $0.00191+ (i. e., 0.0445+ ÷ 0.2322); "the 'difference' between $20 and the $20.67 consisting of copper" is $0.67. This sum would purchase almost 2.6 pounds of copper, that is, nearly 18,200 gr., and there are only 51.6 gr. of copper in the $20 gold-piece! What does Mr. Thane really mean?

Quoting once more, Mr. Thane refers to "the fact that the value of the gold produced, being fixed in price by the Government, therefore enjoys no increase in its market value."

In controversion of this statement that the market-value of gold does not increase (as well as diminish) it seems only necessary to cite the fluctuations in values as quoted, for example, in the various stock-exchanges, where the market-value of gold practically may be said to be constantly rising and falling. The ups and downs in quotations mean, respectively, decreases and increases in the market-value of gold as compared with the properties in question.

W. DE L. BENEDICT.

Monterey, August 6.

The Status of Gold

The Editor:

Sir—The letter of Mr. Bart Thane in your issue of August 3 is answered by another from Mr. W. de L. Benedict in the same issue. If another value of gold were seriously considered by statesmen, there certainly would be an immediate disappearance of the confidence now held by foreign countries in the good faith of the United States to uphold the value of the dollar. Even the mere suggestion of such a scheme in your periodical, circulating as it does in many foreign countries, might be harmful to the credit of the United States.

Is not the only aid to the situation Mr. Thane describes to be found in the cultivation of confidence in the value of silver by every national law international agreement possible?

BLAMEY STEVENS.

Los Angeles, August 5.

PLATINUM exported from Colombia in 1917 was valued at $2,160,000, compared with $1,350,000 in 1916, and $607,500 in 1915. At the average New York price—$103—of platinum in 1917, last year's output was 21,000 oz., against 16,000 oz. in 1916, and 12,000 oz. in 1915. 'El Nuevo Tiempo', a Bogota paper, states that the value of gold and platinum recovered in the El Choco region from 1654 to 1917 totals $211,732,110; and if the precious metals from the department of Antioquia were added, the total would be doubled.

Lieutenant Forbes Rickard, Jr.

The casualty list of August 4 stated that Lieutenant Forbes Rickard, Jr., had been killed in action. Recent letters from him mentioned the fact that he was billeted with Scottish and Australian troops, and it is believed that he was with the force that captured the village of Meteren, in the Bailleul sector, upon the second day of the Allied offensive. The official dispatch said that he was killed on July 19. The eldest son of Forbes Rickard, of Denver, Colorado, he was a young man of unusual promise. He graduated with honors from

LIEUTENANT FORBES RICKARD, JR.

Bowdoin college in the class of 1917 and won a post-graduate scholarship at Harvard, but this he relinquished in order to go immediately to the officers training-school at Plattsburg, where he did so well that he was offered the choice between a first lieutenancy in the National Army and a second lieutenancy in the Regular Army. He chose the latter and was assigned to Camp Greene, where, after a short interval of further training, he was promoted to first lieutenant. He sailed for France in April and had been in active service for less than a month when the end came. He was 22 years of age, 6 ft. 2 in. tall, broad-shouldered, a splendid specimen of young American manhood, as fine in body as in mind, and to these natural gifts he added a courtesy and considerateness that endeared him to all that knew him. As valedictorian at Bowdoin in June 1917 he delivered a poem that speaks for itself. No finer expression of the young American ideal in these great days has been uttered. Note the last line. As he wrote it, so he lived it. We bow our heads in sorrow; we lift them with pride.—T. A. R.

We who are met in these last precious days
That crown the largess of our fateful years
Lift now our parting song. The darkened ways
Spread wide before us, and our youthful tune,
Sad in the loss that lies too deep for tears,
Faints on our lips, and finds its end too soon.
Commencements past have opened peaceful doors
To those young lives so eager to begin,
And showed the promise of far-ranging shores
Where life was sweet, and all the world to win;
We lift our eyes to sacrificial wars
Where death is peace and weary ranks are thin.
Our road leads on to fields in flaming France,
Across the seas our strength shall make secure;
And as bright youth leads on the grim advance
Our bannered hosts shall make old freedom sure,
Not by our strength alone, but by the might
Of honor warring with a crumbling wrong,
By Belgium's brave defiance in the night
Of her most certain doom, and in the long
Brave suffering that made her name a light
For us to follow, by her soul made strong.
And by the noble martyrdom of France
Who cried "They shall not pass," and did not yield,
But checked the fury of the foe's advance,
Giving her bleeding body for a shield;
By England's glory and the distant call
That raised a host where'er allegiance led,
Though half the world away, and brought them all
To fix the crown of Empire on her head.
And by the strength of those all-honored dead
Who cannot see fulfilment of the end
They died to win—but in their bodies' stead
Give us their spirit's strength, and hail us friend.
Their work is done, and though they could not stay
They built the glory of a later day.

Deep-brooding pines, beneath whose aging peace
The sunlit faces flash, and turning go—
Remember us, who take a swift release
And in far lands defend the best we know.
Deserted halls, that echoed to the sound
Of these our voices seeking after truth—
Forget the carelessness you often found;
Remember still the strivings of our youth
That mixes dreams with laughter, songs with tears,
Pure gold with dross, and never will confess
The deepest of its loyalties and fears
Till suddenly it renders all—no less.

FORBES RICKARD, JR.

June 21, 1917.

Physiological Effects of Gases on Man

A compilation of the properties of gases found in mines has been made by G. A. Burrell, and issued as a chart by the U. S. Bureau of Mines. It is useful to those operating in metal mines as well as in coal mines. An abstract of the statement is given below.

Oxygen. In some persons breathing is affected when the proportion of oxygen in the air drops to 13%. With 10% the breathing is distinctly deeper and the lips become slightly bluish; with 7% life is endangered and unconsciousness soon follows. These statements refer to persons at or near sea level when they suddenly enter low-oxygen atmospheres. By acclimatization man becomes accustomed to low-oxygen atmospheres; for instance, men live at altitudes of 12,000 ft. or higher, where the percentage of oxygen by volume is equivalent to air at sea level that contains 13% or less of oxygen. In coal mines a low-oxygen atmosphere means that the ventilation is poor. Coal reacts with the oxygen of the air in mines, and sometimes absorbs and holds it to such an extent that the residual atmosphere does not contain enough oxygen to support life.

Carbon Monoxide. This is a colorless, odorless, and tasteless gas, which is very poisonous; 0.05% carbon monoxide is sufficient to produce in time slight symptoms of poisoning; 0.12% may produce slight palpitation of the heart in 30 minutes, a tendency to stagger in 1½ hours, and impairment of sight and hearing and confusion of mind, headache, and sickness, in 2 hours; 0.2% is very dangerous to man. Exposure for 20 minutes to air containing 0.25% may bring on nausea and headache lasting 12 hours. Canaries collapse in atmospheres containing 0.15% of monoxide in 18 minutes, and show distress in 3 minutes; hence they can be used to warn men of the presence of carbon monoxide. The gas may be present in deadly proportions in an atmosphere in which a miner's lamp will burn, so that the lamp gives no warning of its presence.

Hydrogen Sulphide, Nitrogen Oxide, and Sulphur Di-oxide. These three gases are all harmful to man even in quite small proportions. As little as 0.05% produces almost immediate distress in canaries and mice.

Methane. Methane has no physiological effect when breathed, but may render air unfit to breathe by diluting it until the proportion of oxygen is too low. This gas is very explosive when mixed with air, and because of the quantities in which it is formed is the most dangerous gas generated in mines.

Carbon Di-oxide. Carbon di-oxide does not usually cause distress in man until 3 to 4% is present in the air. Men may work for a considerable time in such an atmosphere, but are more quickly fatigued; 7 to 8% causes more urgent symptoms; 10% causes marked distress, severe headache, heavy panting, throbbing of the heart, flushing of the face, and stupefaction. Carbon di-oxide stimulates the so-called 'respiratory centre' in the brain, and makes a person breathe more air in a given time. As little as 1.4% may cause an increase of 50% in the volume of air that is breathed. This deeper breathing consumes energy, just as work does, and limits the amount of work a man can do, in proportion to the quantity of carbon di-oxide breathed. Breathing a large amount of carbon di-oxide produces a poisonous action because the carbon di-oxide in the air breathed prevents the blood from giving off the carbon di-oxide in the lungs.

Nitrogen. Nitrogen is physiologically inert, and is harmless to man. It has no effect other than to act as a diluent of the oxygen in the air.

Effect of Warm, Moist, and Still Air. A hot moist atmosphere prevents the evaporation of the perspiration. If the hot moist air is stationary, it becomes entangled between the clothing and the skin and becomes warmed to the body temperature. Hence the body cannot lose heat to the air and the skin becomes warm, flushed, and bathed in perspiration. Setting the air in motion by a fan whirls the hot air away from the body and allows cooler air to take its place; hence the beneficial effects of a fan in a room, even if fresh outside air cannot enter. If the wet-bulb temperature of the air is the same as that of the body, 99° F., the body cannot lose heat, but if the air-temperature is about 70° F., perspiration can evaporate. Above 75° F. wet-bulb temperature, the amount of work a man can do begins to decrease. Between 80 and 85° F., wet-bulb temperature, hard continuous work is almost impossible. Wet-bulb temperatures are determined with a sling psychrometer.

The Germans, hard pushed for supplies of copper and lead, are reported to have found an efficient substitute for pipe made of these metals. Successful experiments are said to have been made with pipe manufactured chiefly of paper, and possessing three to four times as much resistance against interior pressure as leaded pipes, while they weigh only about one-ninth as much. Their strength, as compared with copper pipe, is as 1 to 6, and their weight as 1 to 7, but it is added that if paper pipes were made equal in weight to copper pipes they would be equal to them in strength also. If the paper pipes are well glued they should have sufficient power of resistance to be used as gas-pipes.

War-bread causes no serious digestive difficulties when combined with a mixed diet such as can be had in cities, but in remote districts, where the fare is more limited, it is important to know that researches made in France show the need of avoiding salt altogether in preparing bread made of substitutes for wheat. Instead of salt weak lime-water should be used in mixing the dough. Daily ingestion of too much salt causes failure to assimilate protein and other nitrogenous substances, resulting in loss of energy, and an abnormal increase in the appetite. Excessive use of salt leads to acidity of the stomach, also, and this effect is more pronounced when war-breads made with salt are eaten.

ANCIENT WORKINGS UNCOVERED IN PREPARING STEAM-SHOVEL BENCH AT CHUQUICAMATA

Tunnel-Blasting at Chuquicamata

By E. E. BARKER

In blasting for steam-shovel work at Chuquicamata, where the height of the bench now being operated is about 180 ft., there were many problems to be solved before satisfactory work was accomplished. In consequence of the high cost of drilling with churn-drills, namely, $3.60 per foot, some other means of blasting had to be found. The excessive cost was due to the hardness of the rock, and to the many seams and fractures throughout the deposit, causing excessive breakage of tools. Also the high cost of coal ($23 per ton) was an important consideration. The comparison of drilling records on this material with those from drilling in such porphyries as the Nevada Consolidated orebody shows an average footage per 9-hr. shift at Chuquicamata of eight to twelve feet as against an average in Nevada of 60 ft. This large difference, together with the increased cost of supplies in South America, readily shows that churn-drill costs in the soft-porphyry mines cannot be equalled in the harder granite at Chuquicamata. This work at the Nevada Consolidated in normal times cost a maximum of 50c. per foot.

The higher the banks became, starting from the contour and finally reaching 180 ft., the more footage was necessary, so that, say in a 150-ft. bank, one had to balance a drill-hole of 150 ft., together with the expense of springing a pocket for the blasting charge, against the cost of running a mine-drift 25 ft., which was the spacing between the drill-holes. Blasting by churn-drills, even to a height of 60 ft., in this material, cost as high as 25c. per ton, so that it became evident early in the blasting operations that some other method must be devised. The result was that the blasting methods were changed from churn-drill holes to underground tunnels. It is surprising to find how little is written on the subject; accordingly the work in blasting by tunnels was experimental from the start.

Questions such as the following had to be solved:

1. How deep below the steam-shovel grade should blasting drifts be driven?

2. How deep into the bank, or at what horizontal distance, should the blasting-drifts be spaced?

3. Would it be possible to blast with the black powder in the containers piled as it were in a magazine, or would it be necessary to open the containers and deposit the powder loose in the blasting-chamber?

4. Would the danger of the operation of loading exclude the use of the method, and what plans for safety might be necessary to diminish this danger?

5. In blasting by electric current, what system of wiring should be used, whether series, multiple-arc, multiple-series, or series-multiple, and what voltage of current should be used?

6. Would it be necessary to concrete the cross-cut between blasting-drifts, or would run-of-mine tamping be sufficient?

7. Could mining operations (driving) be carried on at the same time that loading was in operation in the drift to be blasted?

8. What saving in cost could be effected by the tunnel-method of blasting over that of the churn-drill?

9. What kind of explosive should be used as a detonator, and what ratio should the detonation-charge bear

to the blasting-charge, and how should it be placed?

10. In calculating the powder requirements for a given tonnage, should the powder charges be calculated on the cubic metres to be broken, or in direct proportion to the line of shear (least resistance)?

11. At what intervals should the blasting-charges be spaced along the drift to be loaded?

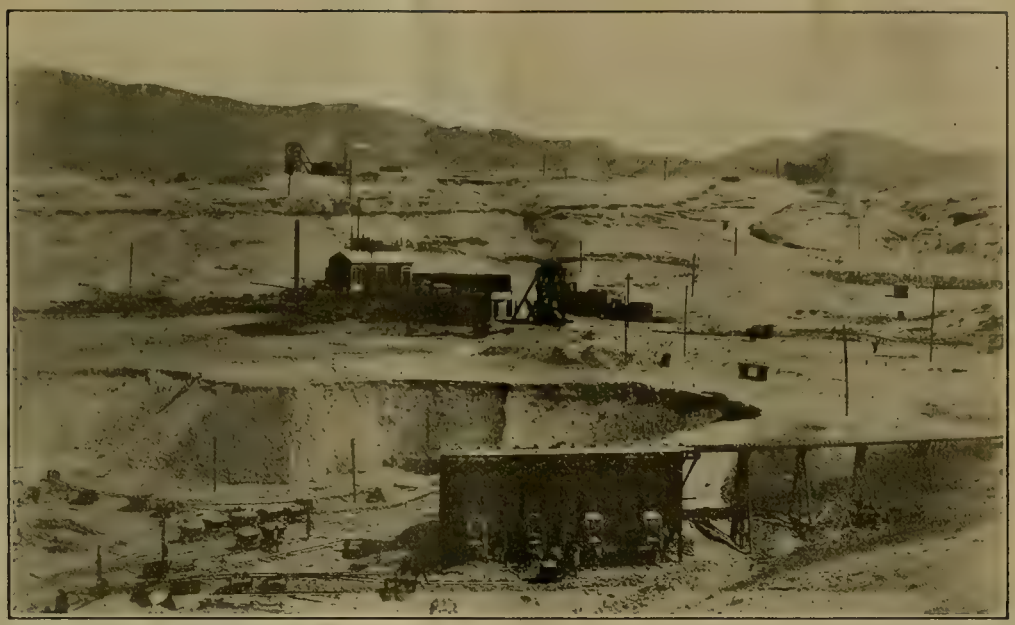
The above questions give an idea of the many problems that confronted us in laying out this work. To start with, the floor of the blasting-tunnels was placed three metres below the floor of the steam-shovel grade, and the horizontal depth into the bank was made 15 m. In deciding on the depth below grade, one had to be certain that the blasting-charges were low enough so as to leave no hard bottom for the steam-shovels. In the many blasts that followed, 3 m. was found to be satisfactory, and where the height of the bank was 45 m., the horizontal distance was increased to 30 m. It was found that the horizontal distance could be two-thirds of the height of the bank to be blasted, so that the spacing of the drifts became 15 m., 22½ m., or 30 m., depending upon the height of the bank. By exhaustive experiments it was ascertained that the best form of wiring was in multiple-series, that is to say, five strings of caps each, and these connected in multiple to the main blasting leads. In each case all charges were double-primed, each cap of the blasting-charge being connected to an independent series of wiring back to an independent transformer, both controlled by the one switch on the higher voltage-line, which in this case carried a current of 500 volts, so that in case of failure of any part of one series of connections, the blaster was protected by having the second series to depend upon. From the figures that follow, when it is realized that a blast of this kind may cost upward of $50,000 for its preparation before the blasting-switch is thrown, it is seen that great care must be exercised to insure success.

The detonation of these charges, the best spacing of which was found to be 10 m. centre to centre, was accomplished by the use of 60% nitro-glycerine dynamite; the proportions of dynamite used being 2% of the weight of the blasting-charge. The detonators consisted of two or three boxes of dynamite per charge, the top of one of which had been previously removed, a hole bored in each side of the case, and two sticks primed with a No. 6 electric exploder. The fuse-wires were placed through the hole of the box on each side, each cap being connected to its separate system of wiring. This case of dynamite, with others alongside, if necessary, was placed in the heart of the black-powder charge, which was loaded in the containers, cans, or sacks, as the case might be, without any attempt being made to open them. Each set of leading-wires was placed in grooved 2 by 3-in. lumber, and battened down with half-inch battens over the top of the groove. These conduits were placed one on either side at the bottom of the drift, the fuse-wires of each detonator being connected in series to its system of wiring.

The first blast fired was bulk-headed in the connecting cross-cut to the next in the rear by a 10-ft. block of concrete. After the shot, the concrete was so undisturbed that this procedure was found unnecessary, and the cross-cuts were subsequently filled with run-of-mine rock only. Since the gases formed by an explosion of black powder are said to be about 300 times the original volume at 60°F., and since the increase in volume for each 5° rise in temperature is 1%, it is estimated, from the fact that fused feldspars were found in the vicinity of the blast, that the temperature of the explosion is at least close to 2000°F. This would give a volume of gas 1164 times the volume occupied by the original charge, so that the refinements in loading with a charge of this size, in taking pains to fill all interstices and voids, is altogether unnecessary. The loss in explosive force would be at the most but a small fraction of one per cent. Since the gas is formed almost instantly, there is no time for this volume to get through the cross-cut tamped with mine-rock, and the breaking of the bank follows.

Although there is danger attached to all forms of blasting, when powder is handled without opening the containers, when electric safety-lamps are used, and strict regulations are enforced as to smoking and carrying matches, the danger of the operation is greatly minimized. Doors were placed in the cross-cuts at the entrance to the drifts to be loaded, with only the blaster and his crews having access to this compartment. The loading of the drifts was done at night, as there were fewer men on that shift working in the mine, and also fewer on the steam-shovel bench. As far as possible, it was aimed not to have steam-shovels working in front of the sections which were being loaded. It was found that mining operations could be carried on in the drifts next to those being loaded, so that this work need not be retarded during the time of loading. Blasting by tunnels is, of course, not new, but the usual way was by an adit with drifts. This was impracticable with steam-shovel work, because each time a shovel would pass the entrance to the tunnels would be lost, so that it became necessary to sink shafts some distance back from the working-face, and to drive the blasting-drifts from a cross-cut extended from the bottom of these shafts.

The largest blast at Chuquicamata was fired in three sections, the plans of which are given in Fig. 1, 2, and 3 respectively. That shown in Fig. 1, representing section 1, was blasted November 19, 1916; section 2, Fig. 2, November 21; section 3, Fig. 3, on November 26, 1916. These sections could have been fired simultaneously, except for the steam-shovel equipment, which had to be changed from one section to the other, so that ore-loading operations could be carried on without interruption, as the firing of the three sections would have tied up the greater part of the face. Section No. 1 consisted of 29 drill-holes in shallow ground, and 267.3 ft. of drift, as seen in the illustrations. Section No. 2 consisted of 29 churn-drill holes and 724 ft. of drift; in this case two parallel drifts being fired simultaneously. Section No. 3 consisted of 1318.6 ft. of drifts, showing a section in which 30 m. in horizontal distance was blasted for the



RECLAIMING OLD DUMPS REPRESENTING ORE REJECTED BY EARLIER OPERATORS

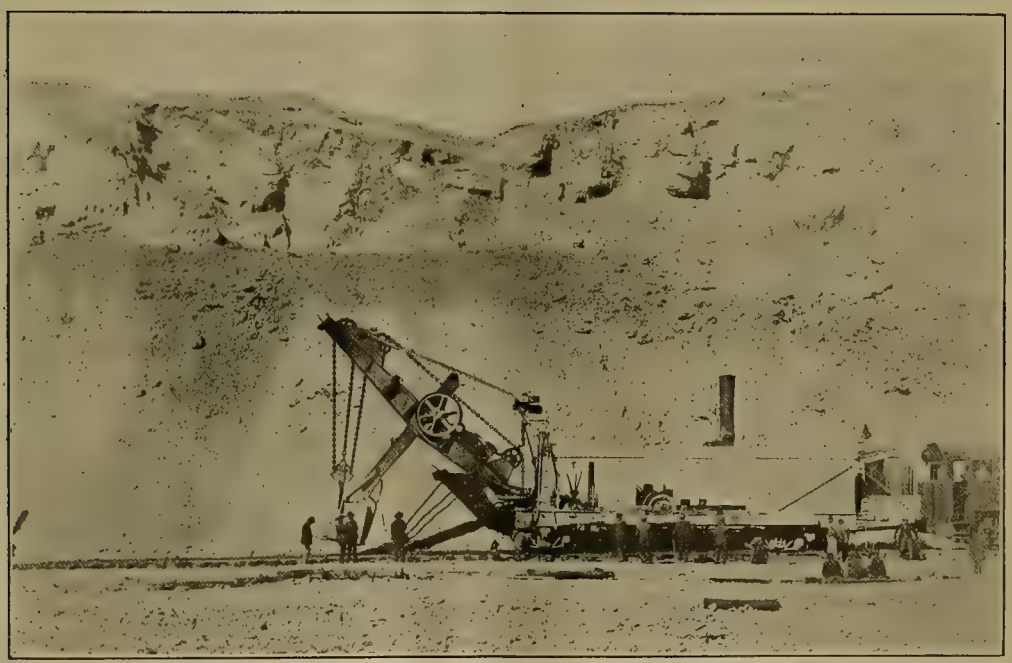


FIG. 10. SHOWING FINENESS OF ORE BROKEN IN BLASTING A BANK 160 FT. HIGH

first time. Details of the quantities used appear on each plan, but the grand total of explosives consisted of 813,000 lb. of black powder, and 85,850 lb. of dynamite, or 450 tons, which broke 1,229,716 tons of ore at a cost of 10.59c. per ton. The cost of the blast by sections follows:

Section I—Tunnels and Blast-Holes Separated

Tunnel 'K', 3659—Blasted 11/19/16—7 charges

Ground broken, 49,840 m. = 65,188 cu. yd. = 140,644 short tons.

Drifts and cross-cuts, 81.5 m. = 267.3 ft. at $13	$3,474.90
Filling, 50.9 m. at ₱13 Chilean pesos = ₱661.70 at $4.50	147.00
Explosives:	
Black powder, 125,000 lb. at $0.0608	7,600.00
60% dynamite, 2500 lb. at $0.302	7.55
Lead-wire, 1100 ft. at $4.25 per 500 ft	9.35
Exploders, 14 at $4.54 per 100	0.64
Casing for wiring 600 linear ft., 500 board ft. at $72 and labor, etc.	40.00
Transportation (burros), 8 days at $10.53	84.24
Labor:	
Loading gang, 5 days at ₱104 Chilean pesos = ₱520, at $4.50	115.50
Hoist-man gang, 2 days at ₱9 Chilean pesos = ₱18, at $4.50	4.00
	$12,230.63

8.7c. per ton.

Churn-Drill Holes, South End—11/19/16

Ground broken, 41,680 m. = 54,514 cu. yd. = 117,620 short tons.

Holes shot, 29	1,944 ft.	
Holes lost, 11	735 ft.	
	2,679 ft. at $3.60	$9,644.40
Springing (4 springs):		
60% dynamite, 9750 lb. at $0.302		2,944.50
Spool conducting-wire, 21,500 ft. at $0.0021		45.15
Exploders, 160 at $4.54 per 100		7.26
Labor (1st and 2nd springs, 20 in ½ day, 3rd and 4th springs, 20 in 1 day), 6 days at ₱104 Chilean pesos		139.00
Blasting charges:		
60% dynamite, 46,975 lb. at $0.302		14,186.45
Leading-wire, No. 14, 7800 ft. at $4.25 per 500 ft		66.30
Exploders, 58 at $4.54 per 100		2.63
Labor, 5 holes per day, 6 days, at ₱104 Chilean pesos		139.00
Transportation (burros), 4 days, at $10.53		42.12
		$27,216.81

23.1c. per short ton.

Section II—Tunnels and Blast-Holes Separated

Tunnels A 3569-3584—Blasted 11/21/16—21 charges

Ground broken, 72,190 m. = 94,420 cu. yd. = 203,714 short tons.

Drifts and cross-cuts, 220.7 m. = 724 ft. at $13	$9,412.00
Filling, 178.2 m., at ₱13 Chilean pesos = ₱2316.60, at $4.50	515.00
Explosives:	
Black powder, 165,900 lb. at $0.0608	10,086.70
60% dynamite, 3200 lb. at $0.302	966.40
Leading-wire, 3000 ft. at $4.25 per 500 ft	25.50
Exploders, 42 at $4.54 per 100	1.91
Casing for wiring, 1460 linear ft., 1220 bd. ft. at $72 and labor, etc.	90.00
Transportation, 10 days at $10.53	105.30
Labor:	
Loading gang, 15 days at ₱104 Chilean pesos = ₱1560 at $4.50	347.00
Hoist-man, 3 days at ₱9 Chilean pesos = ₱27 at $4.50	6.00
	$21,555.81

10.6c. per ton.

Churn-Drill Holes, North End—11/21/16

Ground broken, 26,800 m. = 35,184 cu. yd. = 75,912 short tons.

Holes shot, 29	1,263 ft.	
Holes lost, 7	363 ft.	
	1,626 ft. at $3.60	$5,853.60
Springing (4 springs):		
60% dynamite, 4240 lb. at $0.302		1,280.48
Spool conducting-wire, 13,000 ft. at $0.0021		27.30
Exploders, 144 at $4.54 per 100		6.54
Labor (1st and 2nd, 20 springs in ½ day, 3rd and 4th, 20 springs in 1 day), 6 days at ₱104 Chilean pesos		139.00
Blasting charges:		
60% dynamite, 23,375 lb. at $0.302		7,059.25
Leading-wire, 5100 ft., at $4.25 per 500 ft		43.35
Exploders, 58 at $4.54 per 100		2.63
Labor, 5 holes per day, 6 days at ₱104 Chilean pesos		139.00
Transportation, 3 days at $10.53		31.59
		$14,582.74

19.2c. per short ton.

Section III—Tunnels Only

Tunnels, B 3629 T–T 3644 E—Blasted 11/26/16—36 charges

Ground broken, 320,655 cu. yd. = 691,826 short tons.

Drifts and cross-cuts, 402 m. = 1318.6 ft. at $13	$17,141.80
Tamping, 9427 ft., 287.4 m. at ₱13 Chilean pesos	830.26
Explosives:	
Black powder, 522,100 lb. at $0.0608	31,743.68
Dynamite, 60%, 7000 lb. at $0.302	2,114.00
Dynamite, 62%, 2600 lb. at $0.6007	1,561.82
Dynamite, 75%, 200 lb. at $0.30	60.00
Leading-wire, 5500 ft. at $4.25 per 500 ft	46.75
Exploders, 72 at $4.54 per 100	3.77
Casing for wiring, 2 lines, 2210 bd. ft., plus labor	163.92
Transportation, 30 days at $10.53	315.90
Labor (loading-gang), 25 days at ₱105 Chilean pesos; hoist-man, 18 days at ₱9 Chilean pesos	613.78
	$54,595.68

7.9c. per short ton.

Resume of All Three Sections

Tunnels blasted November 1916	Short tons broken	Total cost	Cost per short ton, cents
K 3659	140,644	$12,230.63	8.7
B 3622 T–T 3644 E	691,826	54,595.68	7.9
A 3569–A 3584	203,714	21,555.81	10.6
Total	1,036,184	$88,382.12	8.53
Churn-drill holes November 1916			
At south end of bench	117,620	$27,216.81	23.1
At north end of bench	75,912	14,582.74	19.2
Total	193,532	$41,799.55	21.6
Tunnels and blast-holes			
Tunnels	1,036,184	$88,382.12	8.53
Blast-holes	193,532	41,799.55	21.6
Total	1,229,716	$130,181.67	10.59

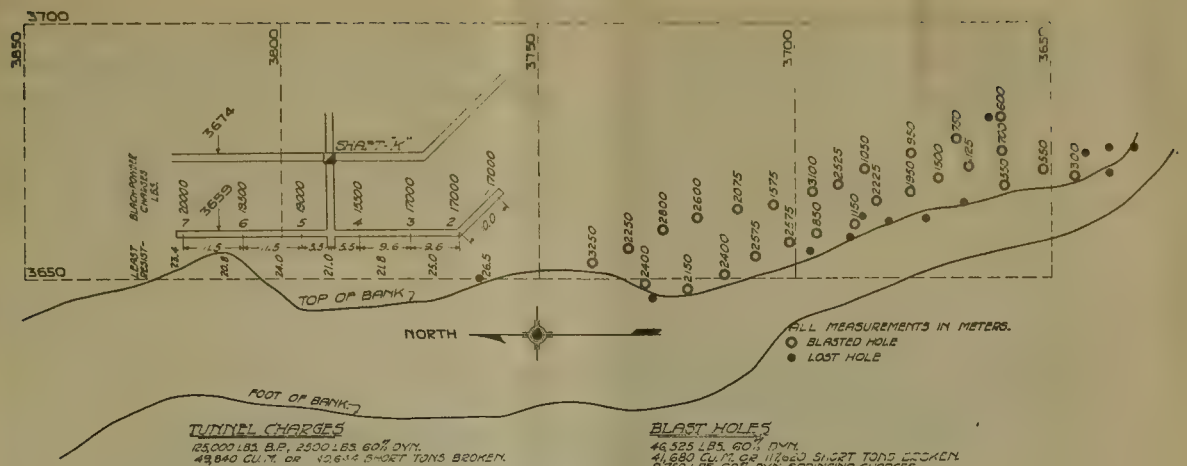
Unit Costs

Costs	Chilean pesos	U. S. currency
Driving, per ft		$13.00
Tamping, per metre	₱13	
Black powder, per lb		0.0608
Dynamite, 60%, per lb		0.302
Dynamite, 62%, per lb. (purchased locally)		0.6007
Dynamite, 75%, per lb		0.30
Leading-wire, per 500 ft		4.25
Conducting-wire, 450 ft., 2-lb. spool		0.946
Exploders, per 100		4.54
Casing for wiring, per 1000 bd. ft		72.00
Labor:		
Loading-gang (9 men), per day	104	
Hoist-man, per day	9	
Transportation:		
10 cargo burros, per day		4.00
3 burros for men, per day		1.20
1 capataz	10	
2 burreros	14	
9 trips of 2000 lb. per day. Total for transportation, per day		10.53
Blast-hole drilling, per ft		3.60

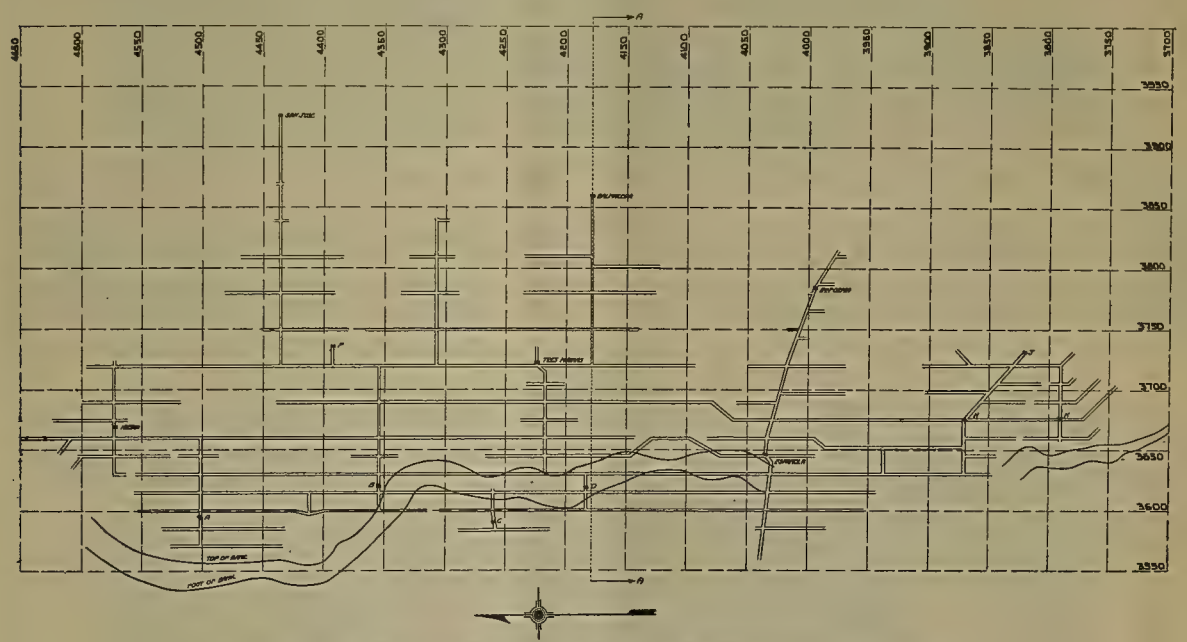
Casing for wiring, 2 lines for total length of drifts and cross-cuts.
Leading-wire, 4 lines for total length of drifts and cross-cuts.
Exploders, 2 for each tunnel-charge.
Exploders, 2 for each blast-hole.
Springing (4 times)—1st and 2nd, 20 springs in ½ day; 3rd and 4th, 20 springs in 1 day.
Loading blast-holes, 5 holes per day with dynamite.

The marked difference in the cost by tunnels, 8.53c., and the cost by churn-drill holes, 21.6c., was forcibly shown by the results of these blasts and proved conclusively that the tunnel-method was doing the work for less than half the cost of the same work by drill-holes. The above costs do not include the expense of block-holing the boulders, following the large blasts; this is taken up later. Neither is allowance made for the proportion of overhead expense.

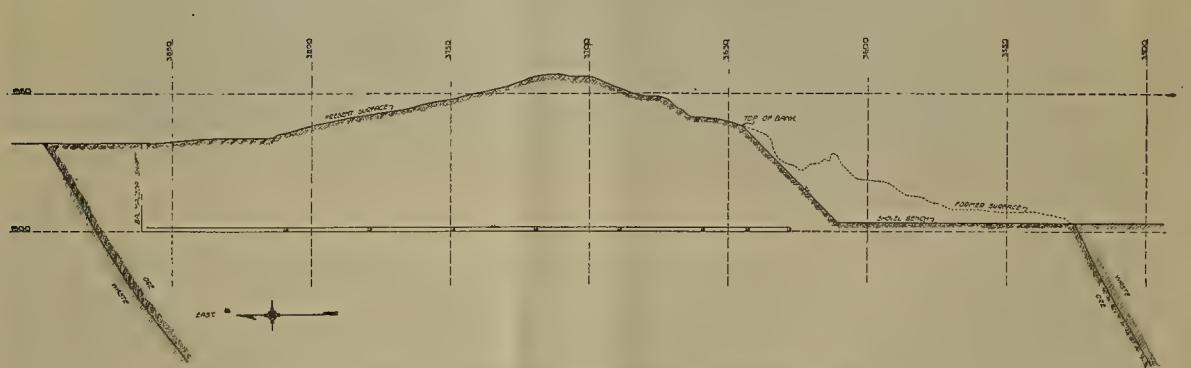
Much controversy has arisen over the so-called method of high banks versus the method of low banks as applied to the work at Chuquicamata, the arguments being that the smaller the height of the bank, the smaller will the rock be broken, the safer the operation, and the more efficient the shovel-performance. On the other hand, with



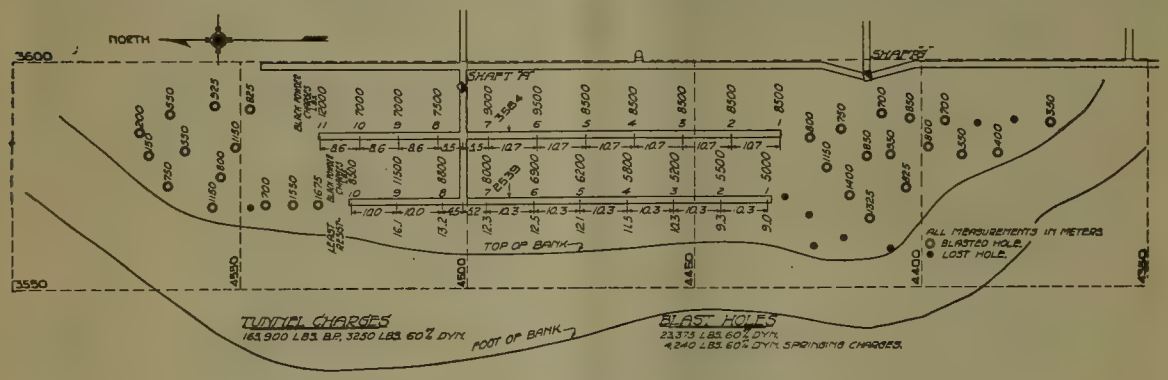
SECTION 1, NO. 10 SHOT FIRED NOVEMBER 19, 1916; ORE BROKEN 258,264 TONS



PLAN OF BLASTING-DRIFTS, CROSS-CUTS, AND SHAFTS; SCALE 1 TO 1600



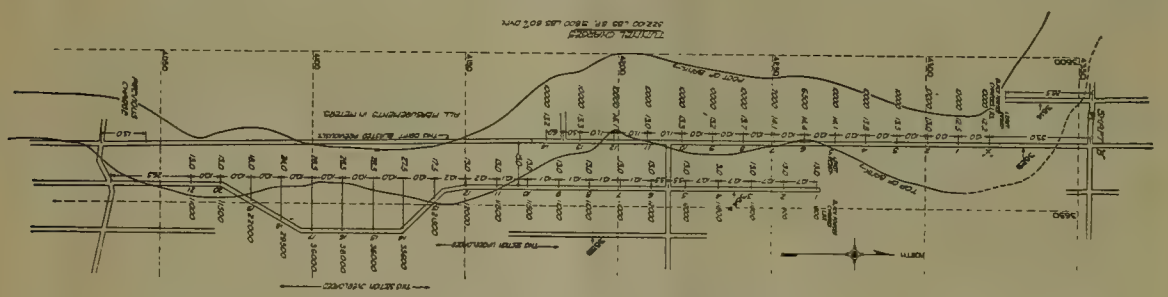
drill-holes, one is apt to have trouble with pockets, leaving hard rock in the bottom for the shovel to handle; missed holes are more likely to occur; and any delay to the churn-drill operation, resulting from lost holes, broken tools, and so on, would mean stoppage in steam-shovel loading, all of which would be reflected in the costs against the low-bank method. The question resolves itself into that of the cost per ton placed in the bins, and



SECTION 2, NO. 11 SHOT FIRED NOVEMBER 21, 1916; ORE BROKEN 279,626 TONS

I do not believe that any increase in shovel-efficiency in the low banks, owing to a lower amount of large rock, will offset the large difference in cost by breaking the ground by the tunnel-method over that of the blast-hole method. While it is admitted that there will not be the same proportion of large rock in the low banks as in a higher bank, it must not be forgotten that in certain

$1944 for the $9644, and the total cost of the drill-hole factor in this shot would be $19,516.81, or 16.6c. per ton, so that even with the high cost of drilling eliminated, the cost per ton broken would still be approximately twice that for breaking the ground in the same vicinity by tunnels. The articles in recent issues of the MINING AND SCIENTIFIC PRESS by Courtenay De Kalb, describing the operations at Ajo, Arizona, are most interesting, and from all I know of the operations there the situation is about the same as we found it in Chuquicamata. Curiously enough, in blasting operations at both places, large rock developed, even in so low a bank as 30 ft., so that primary jaw-crushers of large dimensions were found necessary. In any event large rock will have to be handled at either mine, and I would not be surprised,



SECTION 3, NO. 12 SHOT FIRED NOVEMBER 26, 1916; ORE BROKEN 691,826 TONS

sections, both at Chuquicamata and at Ajo, rock too large to be handled resulted from blast-hole drilling where the banks did not exceed 50 ft., so that low banks do not entirely eliminate this objection.

Churn-drills were used exclusively at Chuquicamata until the heights of the banks reached about 60 ft., and coarse rock was produced continuously, which, together with the resulting hard bottoms, missed holes, and excessively high cost, resulted in this method being superceded by tunnel-blasting, the difference in cost being demonstrated above. In the case of the blast-holes fired in section 1, should there have been no lost holes, and should the net footage, namely, 1944 ft., have cost but $1 per foot instead of $3.60, we would have substituted considering the bank-height of 125 ft., although I do not know the footage per shift that can be made in the Ajo deposit, if a blasting scheme in that property by tunnels would not be found cheaper in the end, although the cost of supplies and fuel is much less than at Chuquicamata.

A premature explosion, where the tunnel-method of blasting was used, might, of course, cause great loss of property and life, depending on the time when the accident occurred, but on summing up the premature explosions from drill-holes, or from other causes in any large blasting operation, the danger would appear to be no greater than in any other form of blasting on a large scale. During the three years of blasting in this way at

Chuquicamata, there never has been a miss-fire, although in the churn-drill blasting there have been several. Missed holes from churn-drill practice are largely accountable to the tamping scouring the leading or connecting wires, so that short circuits develop and the cap in one hole does not explode, while all the rest are detonated successfully. In blasting a string of holes one missed hole is usually hard to locate, and it is not until the shovel is digging in this section that the unexploded charge is found, and in nine cases out of ten, the teeth of the dipper will be into the charge before the powder is discovered, so that the chance for accidents from this source is great. In blasting by the tunnel-method, the blaster's wiring connections, caps, and the like, are all within his reach, and can be inspected carefully, whereas in the drill-hole no one knows what has taken place; it must be taken for granted that the connections in the bottom of the hole are all right. A galvanometer test will show the hole to be safe, when really the wires are perhaps 'shorted' across the cap.

FIG. 12. OLD MINES OF THE DISTRICT, AND HEAD-FRAMES NOW USED TO ENTER BLASTING TUNNELS

With regard to the height of bank best suited to the purpose of selecting ore, I would be inclined to say that the lowest bank consistent with good steam-shovel practice would be the most desirable. It has been found, however, in high banks, that where zones of waste appear, they tend to slide into the shovel-pit, so that fair

FIG. 13. BANK BLASTED, READY FOR STEAM-SHOVEL

sorting can be accomplished, that is, if the bottom of the bank is ore and the top is waste, the shovel will load ore at the bottom until the top caves, after which waste will be loaded, so that there is little to be said in favor of any given bank-height for this purpose. The irregularity of ore and waste is such that no matter how shallow the bank may be, there would be times when ore and waste would be mixed.

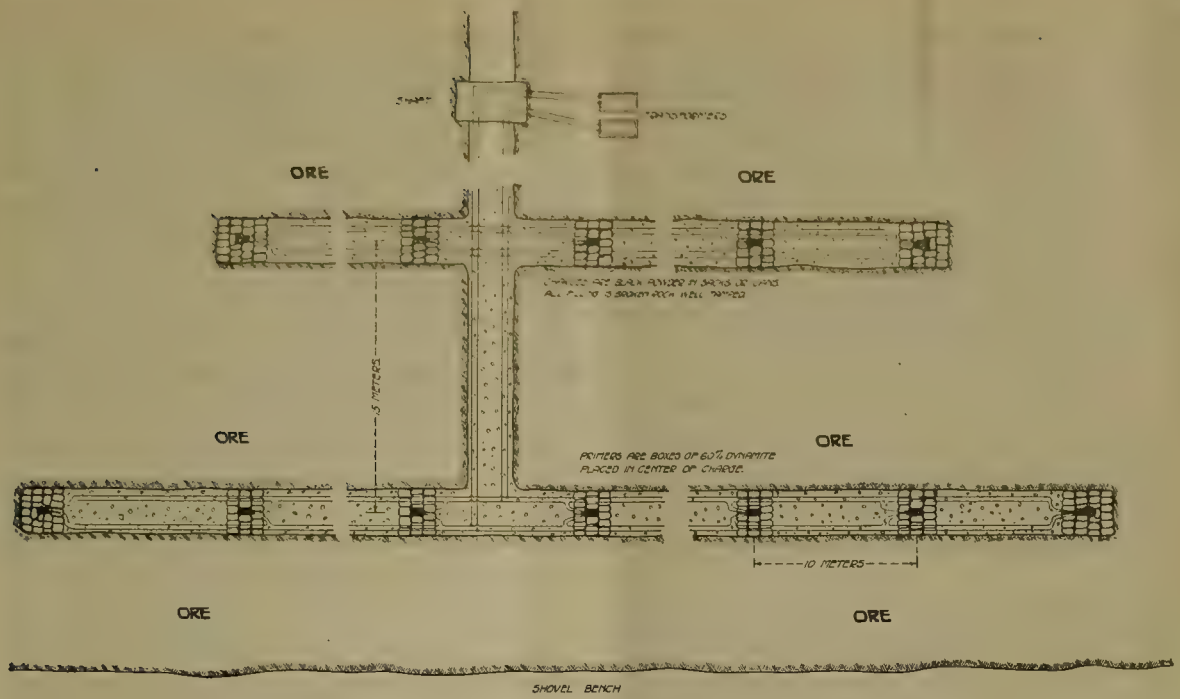
With regard to the large rock found in blasting hard-rock sections, the experience at Chuquicamata was that no matter how these hard sections were shot, the big rock could not be broken in the blasting. Tunnels have been overloaded as much as 100%, and underloaded so as merely to shake the bank, and the results, so far as big rock were concerned, were practically the same. This is true also in the good blasting ground, as the steam-shovel operator understands it, that is, ground that will break fine with low banks in churn-drill blasting also will break fine on a 150-ft. bank with tunnel-blasting. The illustration, Fig. 10, shows how fine the ore was broken in blasting a bank 160 ft. high. In the same photograph, it will be noticed that the blasted ground occupies about one-half the height of the original rock in place, and with the broken bank as shown, there is obtained the most ideal loading conditions as regards fineness of material and height above the loading-track, namely, between 40 and 50 ft. This height in no way endangers either the machine or the crew, and it ensures the greatest number of cars for each move forward consistent with good loading. In the last shovel-cut, where the machine is close to the bank, care must be used to have rocks endangering the machine barred down. For this reason it was decided not to clean up the blasts entirely, which meant the re-shooting of a small amount of ground already blasted. In the end this was more desirable than to clean up the face, thereby endangering the operating equipment.

There were times when hard blocky sections were undershot. This is a costly mistake, as a hard section of bank, which is only shaken, has to be fought with block-holing and jack-hammer work; this is tedious and costly. For that reason it invariably pays to be sure that enough powder is used to break the ground, and, for a safety factor, to overload from 20 to 30% in addition. On the other hand, too much of an overload scatters the bank, so that track shifting becomes excessive, and the resulting low banks of broken material call for much moving, and give a low steam-shovel efficiency. Successful blasting under any given set of conditions, requires experience, for example, a given quantity of powder that will break a certain tonnage in one case may over or undershoot the same quantity in other conditions. The softer the rock usually the greater the blasting-charge necessary, as soft material tends to spring, while the harder rock will break with the same charge.

Much has also been written of the merits of different blasting-powders, many claiming that dynamite will fracture the rock finer. In blasting on a large scale this is not so. Were enough dynamite used to shatter the rock, the bank would be blown all over the steam-shovel bench. Dynamite, of course, does shatter more than black powder, on account of its rapidity, but only close to the blasting-charge. In calculating the charge to properly break a bank, practically the same conditions result, whether dynamite or black powder is used. Black powder for Chuquicamata was made at Calama, a town 15 miles distant. The ingredients used were, roughly, 75% sodium nitrate, 15% charcoal, and 10% sulphur. Extreme care was not used in this mixture, nor were the ingredients analyzed, but the powder was grained and glazed, and was most satisfactory. It cost, delivered at the mine, about 6c. per pound, and a given amount of 40% dynamite was equal in blasting-strength to about one and a half times the weight of the powder of local manufacture. Black powder was, all things considered, by far the most satisfactory, although many varieties and grades of explosives were tried. The commercial $NaNO_3$ used in this powder was as a rule rich in $KClO_3$. Higher-grade dynamites were used as a rule in drill-hole blasting, in order to get the most out of the pockets formed by springing, as previously stated. Recent photographs of the Cornelia Copper Co.'s work on shallow banks, showing the many big boulders, are typical of many sections at Chuquicamata on similar heights of bank. The cost of breaking these boulders at the latter place, previous to the time of the installation of the coarse jaw-crushers, was as much as 5c. per ton, and even higher in exceptional cases. After the erection of the coarse crushers, which could take practically anything that could pass through the steam-shovel dipper, the costs for block-holing dropped below 2c. per ton.

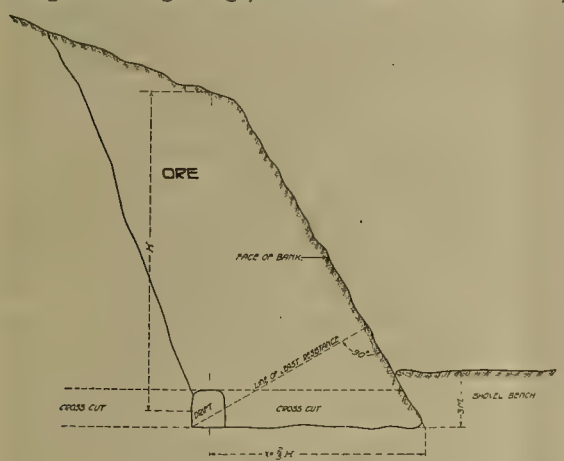
It will be seen, from a study of the blasting plans, that as wide a range as from 400 to 1200 lb. of black powder was used per linear metre of line of least resistance. It was early demonstrated that the height of the bank was of little importance in calculating a blasting-charge, that is, if the line of shear was 50 ft., the blasting-charge would be approximately the same, whether the bank was 100 ft. high, or of indefinite height. A drift through a section of 'hog-back', with the same line of shear throughout, and with heights of 40 ft. at each side of the ridge, and 130 ft. in the centre, was loaded on a basis of cubic yards to be broken, in order to prove this principle. The result was that the centre of the blast, or the point under the high part of the ridge, was greatly overloaded, while the section of low-bank heights was properly broken. The resulting pile of broken rock formed a semi-circle, with a point under the highest part of the ridge taken as a centre. It was clear from this point that it was necessary to calculate on the line of least resistance only, and this practice was thereafter followed.

Owing to the variable conditions in the rock to be broken, no empirical formula could be devised, and it was only from blasting in certain sections that knowledge was gained as to what factors per metre of least resistance should be used. The cost of driving the drifts, $4\frac{1}{2}$ by $6\frac{1}{2}$ ft. in section, at Chuquicamata, varied from $10



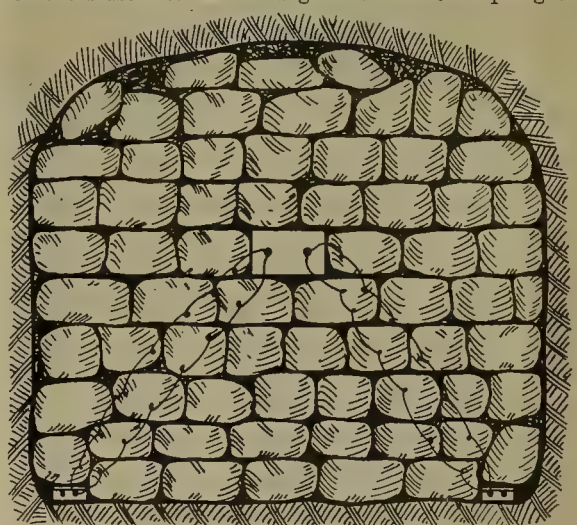
GENERAL ARRANGEMENT OF BLASTING CHARGES AND ELECTRIC CONNECTIONS

to $20 gold per foot, with an average of $13. The ground being hard and dry, no timbering was required. Muck was trammed from the faces in buckets on trucks, and during the operation of loading the space between the blasting-charges was filled with run-of-mine by this equipment. The greater spacing of the drifts required a larger blasting-charge, which filled from 70 to 90%



IDEALIZED SECTION

of the tunnel. No chambers were required to accommodate the blasting-charge, as the charges were loaded in the drifts themselves. The greater the space between the drifts, of course, the less cost per ton broken. In the beginning, it was useful to have the drifts spaced 15 m. only, so that, in case the blast were undershot, the drift immediately behind could be re-loaded, this time with an overload, and the material of both blasts knocked down successfully. This did not happen often, but it is well for the blaster to know his ground before adopting the maximum spacing. The factors per line of least resistance, on a 30-metre spacing, show an increase per metre over the factors for a 15-metre line of least resistance in the same ground. The loading of drill-holes on the basis of a given factor per foot in depth of hole, with the slope as a constant ratio, always gave good results, as the line of least resistance is proportionate to



LEADING WIRES IN COVERED GUIDES; 60% DYNAMITE PRIMERS IN CENTRE

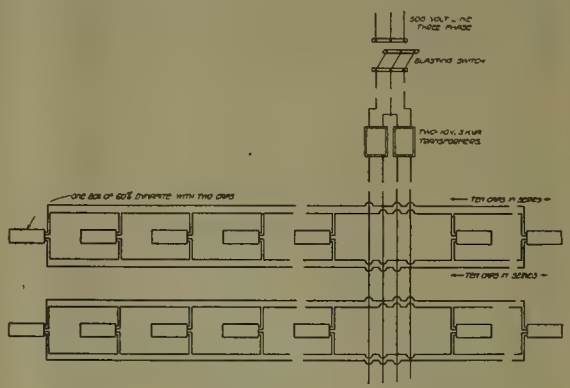
this height. Where the horizontal distance is uniformly two-thirds the vertical height, the factor per cubic metre works out well, and varies in this material from 1½ to 2½ lb. per cubic metre to be broken.

After a blast by the tunnel-method, and before the miners are allowed to return to work in the blasting-tunnels that are in preparation, the helmet-crew, consisting of three men, one or more supplied with a bird in a cage, descend into the mines, and test all the drifts for bad air. The helmet-crew usually does not enter until 24 hours after the blast, and it is seldom found that gases entering the mine interfere with the work for a longer period than 48 hours. It is always well to maintain a regular helmet-crew to do nothing but act as a life-saving squad. They should have regular exercises and duties to perform daily, in connection with their work, and be always available at a moment's notice, because, in the case of a premature explosion, the great danger to the men underground would be from asphyxiation.

A blast is described in a recent bulletin of a powder company, in which the adit of the 'gopher', amounting to 30 ft., and a part of the branch of the 'T', were completely filled with concrete. This we know now to be a useless expense, as the gases formed have no time to force their way through such a small opening. The principle is similar to the lesson that the small boy usually learns in trying to shoot the stuck wadding out of his gun with a fresh cartridge, or like the novice who tried to 'dynamite' the fish by sticking the muzzle of his shotgun under the water and pulling the trigger.

The springing of churn-drill holes is at best a most unsatisfactory procedure, as one is never certain that the pocket sprung is going to be large enough to accommodate the blasting-charge. If not large enough the powder will rise in the barrel of the hole. In the case of blasting at Chuquicamata, it was most essential to have a pocket of ample size, because, when the bottom could be successfully blasted, the top would take care of itself. In springing with 75% nitro-gelatin, which is the best explosive found for this work, from 12 to 15% of the weight of the full blasting-charge as a rule was used to spring the pocket. So much has been written about springing holes that I need make no comment here other than to say that the quantities used in springing holes usually increase in multiples of three, when the chamber is springing as it should. Where the collars of the drill-holes are likely to blow out, and where the ground is soft, and manifests a tendency to cave, it is often best, where the blaster has plenty of time, to use sand instead of water, and to fill the hole each time. This is costly, as the drill has to be placed over the hole each time to clean out the sand from both the hole and the pocket. Where the springing of drill-holes is in good ground, and where water can be used successfully for tamping, the usual rule is to use a gallon of water per pound of springing-charge, the quantities to be varied afterward according to the results obtained. By the use of a mirror to reflect the sunlight to the bottom of the hole, and by means of the tamping-dolly, which consists of a piece of round wood 36 to 40 in. long, tied preferably to a piece of window-cord, the blaster soon learns, within reasonable limits, whether or not he will be able to 'chamber' the charge in the pocket. When a hole gives trouble—and there are few that do not—the blaster tries to make up the difference in the blasting-powder necessary in the two adjacent holes. This invariably leaves a hard bottom for the shovel to work against, thereby seriously interfering with efficiency in loading.

A pocket that proves to be too small is disconcerting, as, for example, when the blaster had calculated that 5000 lb. of charge was required and then finds that the pocket is full after 1000 lb. has been placed in the hole. The illustrations show the starting of work in opening the steam-shovel bench at Chuquicamata. The entire



SCHEME FOR WIRING

outcrop of the deposit, which is about three kilometres long by half a kilometre wide, is honeycombed with old workings and small dumps, some dating no doubt from pre-Incarial times. These in some respects were an advantage, as the excavation for railroad construction through these dumps was cheap, but they interfered with the churn-drill operations, since the holes required casing in sinking through the dumps and the old workings. The dumps were excavated for about 25c. per cubic metre by native hand-work, and the hardest rock was excavated for 80c. per cubic metre. During the earlier excavation stone hammers, wooden shovels, wooden gads, and the leather *capacho,* as well as mummies of the Indians themselves, were found. As soon as the natives discovered that these articles possessed a value in the eyes of the gringo curio-hunter, there was always a scurry by all hands after each large blast to gather the souvenirs of the prehistoric miners. A good collection of these curios is on exhibition at the Museum of Natural History in New York, together with a mummy of a miner upon whose body is precipitated a green coating of copper. The mummy was entombed for many hundreds of years, and the copper deposited upon him caused him to be called the 'copper man'.

It was a gala day for the natives on September 18, 1914, when they beheld the first steam-shovel starting to

work with its snorting and hissing of steam, and the bucket, which seemed so monstrous to them, loaded a train of 12-cu. yd. Oliver cars in little more time than it takes to tell it. Some were frightened, others, lost in admiration, stood and gazed at the machine, while the bolder ones among the native mechanics wanted to qualify as steam-shovel engineers. There are now being operated at Chuquicamata 8 or 10 steam-shovels, and about 15 locomotives, 1 electric shovel, 2 electric churn-drills, and about 12 steam churn-drills, all of which have been successfully manned by Chilean mechanics. The problem was difficult at the beginning, and required patience and encouraging words, and the training was accomplished in the face of much derogatory criticism. My experience with the native workmen in Chile more than confirmed the views of Henry Perkins, so forcibly stated in his interview with T. A. Rickard, published some months ago in the MINING AND SCIENTIFIC PRESS. The achievements of the better class of Chilean mechanic, even to the drilling of 1500 churn-drill holes with steel lines, goes to show that the men of the Southern Continent are well able to keep abreast of the times in the use of modern equipment. These Chilenos took particular pride in their work, and were very reliable; they were proud of their ability and realized the necessity of not missing a day, because the work of the machine depended on their punctuality. The Chilean laborer has an independent spirit, but at all times is subject to reason. He knows well enough when he is guilty of a breach, and he knows that the reprimand that he receives is justified. Much better results are accomplished by means of piece-work or on contract. In the operation of drilling-machines and steam-shovels, they were paid a bonus for work exceptionally well done. It is better to encourage and to lead the Chilean laborer than to attempt to drive him. It must be said also that I have never met with better workmen anywhere than the gangs of Chilean shovelers working on contract.

METHODS OF GAS WARFARE are interestingly described by S. J. M. Auld, in the Journal of the Washington Academy of Science. The following compounds are used by the Germans: For clouds, Cl and $COCl_2$; for hand-grenades, bromo and chloro-acetone, bromine, chloro-sulphonic acid, dimethyl sulphate, methylchloro-sulphonate, and SO_3; for shells, allyl isothiocyanate (allyl mustard oil), benzyl bromide, brominated methyl, ethylketone (bromo ketone), dibromoketone, mono and tri-chloromethyl chloroformate (palite and superpalite, respectively), nitro-chloromethane (chloropicrin or nitrochloroform), dichlorodiethyl sulphide (mustard gas), diphenylchloroarsine (sneezing gas), dichloromethyl ether, phenylcarbylamine chloride, $COCl_2$, SO_3, and xylyl bromide (tolyl bromide). For protection against chlorine cotton pads soaked in solutions of Na_2CO_3 and $Na_2S_2O_3$ were used. When the Germans started to use $COCl_2$ a helmet saturated with PhONa was developed, but the substance now used extensively by all is $(CH_2)_6N_4$, which, used in conjunction with PhONa, will protect against $COCl_2$ at a concentration of 1 to 1000 for a considerable period. The box type of respirator was developed as the use of gas-shells became extensive. It employs active absorbent charcoal and alkaline permanganate, which will protect against nearly everything used, even up to concentrations of 10% for short periods. The German apparatus has the chemical in three layers, an inside layer of pumice with $(CH_2)_6N_4$, a middle layer of charcoal (sometimes blood charcoal), and an outside layer of baked earth soaked in K_2SO_3 solution, and coated with finely powdered charcoal. It is not equal in efficiency to the American or British respirator, breaking down at a concentration of 0.3% of certain substances.

MUSTARD-GAS, which has been used so extensively in shells, is an organic compound containing chlorine and sulphur, known as di-chlorethylsulphide. It is employed in shells of all calibres up to eight-inch. It produces severe burns if it comes in contact with the body and is painful to the eyes. Food eaten after having been subjected to the influence of mustard gas has been known to burn the lining of the stomach. It is a heavy gas and has a fairly high boiling-point, 400°F., a fact that makes it unsuitable for cloud-attacks, for it must be vaporized by an explosion. The gas has killed men as far back as 12 miles from the front. Mustard-gas will linger a long time in the vicinity of shrubbery and woods and forming pockets in shell-craters, where it contaminates the earth, which often must be treated with chloride of lime if there is any chance of men coming in contact with it. With a favoring wind a mustard-gas shell can be shot over troops and dropped only 500 yd. ahead of them without placing them in danger. Gas-shell bombardment is to be expected everywhere within the range of artillery, in front-line trenches, communication trenches, camps, billets, and other places. The enemy's object, of course, is to catch bodies of men unprotected against gas and to develop a high concentration by heavy bombardment. The practice now is either to mix up the gas and the high-explosive shells, or to use gas-shells containing a fairly large charge of explosive. This makes it difficult to detect the beginning of a gas-bombardment.—'Metallurgical & Chemical Engineering.'

SAND-LIME BRICK production of the United States in 1917, according to the U. S. Geological Survey, numbered 187,546,000, valued at $1,420,330, a decrease of 39,798,000 brick, or 18%, and of $53,743, or 4%, compared with 1916. The drop was due principally to the general decrease in building operations, but in part to scarcity of labor and difficulties of transportation. The value of the output for 1917 was greater than the value of that for any other year except 1916. Sand-lime brick were made in 19 States by 47 operators. Michigan was the leading State, and reported more than one-fourth of the output and value; Minnesota was second. Common sand-lime brick represented 98% of the total output and value. The average price per 1000 for common sand-lime brick was $7.54, an increase of $1.11 over 1916.

The Duty of the Employer to the Crippled Soldier

By DOUGLAS C. McMURTRIE,
Director of the Red Cross Institute for Crippled and Disabled Men, New York City

We must count on the return from the front of thousands of crippled soldiers. We must plan to give them on their return the best possible chance for the future.

Dependence cannot be placed on monetary compensation in the form of a pension, for in the past the pension system has proved a distinct failure in so far as constructive ends are involved. The pension has never been enough to support in decency the average disabled soldier, but it has been just large enough to act as an incentive to idleness and semi-dependence on relatives or friends. The only compensation of real value for physical disability is rehabilitation for self-support. Make a man again capable of earning his own living and the chief burden of his handicap drops away. Occupation is, further, the only means for making him happy and contented.

Soon after the outbreak of hostilities the European countries began the establishment of vocational training schools for the rehabilitation of disabled soldiers. They had both the humanitarian aim of restoring crippled men to the greatest possible degree and the economic aim of sparing the community the burden of unproductivity on the part of thousands of its best citizens. The movement had its inception with Mayor Edouard Harriot of the city of Lyons, France, who found it difficult to reconcile the desperate need for labor in the factories and munition works while men who had lost an arm or a leg but were otherwise strong and well were idling their time in the public squares. He therefore induced the municipal council to open an industrial school for war cripples which has proved the example and inspiration for hundreds of similar schools since founded throughout France, Italy, Germany, Great Britain, and Canada.

The disability of some crippled soldiers is no bar to returning to their former trade, but the injuries of many disqualify them from pursuing again their past occupation. The schools of training prepare these men for some work in which their physical handicap will not materially interfere with their production. The education of the adult is made up largely of his working experience. The groundwork of training in his past occupation must under no circumctances be abandoned. The new trade must be related to the former one or be, perhaps, an extension or specialization of it. For example, a man who had done manual work in the building trades may by instruction in archictectural drafting and the interpretation of plans be fitted for a foreman's job, in which the lack of an arm would not prove of serious handicap. A trainman who had lost a leg might wisely be prepared as a telegrapher, so that he could go back to railroad work, with the practice of which he is already familiar.

Whatever training is given must be thorough, for an adult cannot be sent out to employment on the same basis as a boy apprentice. He must be adequately prepared for the work he is to undertake. The one-armed soldier is equipped with working appliances which have supplanted the old familiar artificial limb. The new appliances are designed with a practical aim only in view; they vary according to the trade in which the individual is to engage. For example, the appliance for a machinist would be quite different from that with which a wood turner would be provided. Some appliances have attached to the stump a chuck in which various tools or hooks can interchangeably be held. The wearer uses these devices only while at work; for evenings and holidays he is provided with a 'dress arm,' which is made in imitation of the lost natural member.

An important factor in the success of re-educational work is an early start, so that the disabled man shall have no chance to go out unemployed into the community. In even a short period of exposure to the sentimental sympathy of family and friends, his 'will to work' is so broken down that it becomes difficult again to restore him to a stand of independence and ambition. For this reason, therefore, the plan for his future is made at as early a date as his physical condition admits, and training is actually under way before the patient is out of the hospital.

In the readjustment of the crippled soldier to civilian life, his placement in employment is a matter of the greatest moment. In this field the employer has a definite responsibility. But the employer's duty is not entirely obvious. It is, on the contrary, almost diametrically opposite to what one might superficially infer it to be. The duty is not to 'take care of' from patriotic motives, a given number of disabled men, finding for them any odd jobs which are available, and putting the ex-soldiers in them without much regard to whether they can earn the wages paid or not, although this method is all too common. A local committee of employers will deliberate about as follows: "Here are a dozen crippled soldiers for whom we must find jobs. Jones, you have a large factory; you should be able to take care of six of them. Brown, can you not find places for four of them in your warehouse? And Smith, you ought to place at least a couple in your store."

Such a procedure cannot have other than pernicious results. In the first years of war the spirit of patriotism runs high, but experience has shown that men placed on this basis alone find themselves out of a job after the war has been over several years, or in fact, after it has been in progress for a considerable period of time. A second

weakness in this method is that a man who is patronized by giving him a charity job, comes to expect as a right such semi-gratuitous support. Such a situation breaks down rather than builds up character, and makes the man progressively a weaker rather than a stronger member of the community. We must not do our returned men such injury.

The third difficulty is that such a system does not take into account the man's future. Casual placement means employment either in a make-shift job as watchman or elevator operator such as we should certainly not offer our disabled men except as a last resort—or in a job beyond the man, one in which, on the cold-blooded considerations of product and wages, he cannot hold his own. Jobs of the first type have for the worker a future of monotony and discouragement. Jobs of the second type are frequently disastrous, for in them a man, instead of becoming steadily more competent and building up confidence in himself, stands still as regards improvement and loses confidence every day. When he is dropped or goes to some other employment, the job will have had for him no permanent benefit. Twelve men sent to twelve jobs may all be seriously misplaced, while the same twelve placed with thought and wisdom and differently assigned to the same twelve jobs may be ideally located. If normal workers require expert and careful placement, crippled candidates for employment require it even more.

The positive aspect of the employer's duty is to find for the disabled man a constructive job which he can hold on the basis of competency alone. In such a job he can be self-respecting, be happy, and look forward to a future. This is the definite patriotic duty. It is not so easy of execution as telling a superintendent to take care of four men, but there is infinitely more satisfaction to the employer in the results, and infinitely greater advantage to the employee. And it is entirely practical, even in dealing with seriously disabled men.

A cripple is only debarred by his disability from performing certain operations. In the operations which he can perform, the disabled man will be just as efficient as his non-handicapped colleague, or more so. In the multiplicity of modern industrial processes it is entirely possible to find jobs not requiring the operations from which any given type of cripples are debarred. For such jobs as they can fill the cripples should be given preference. Thousands of cripples are now holding important jobs in the industrial world. But they are men of exceptional character and initiative and have, in general, made their way in spite of employers rather than because of them. Too many employers are ready to give the cripple aims, but not willing to expend the thought necessary to place him in a suitable job. This attitude has helped to make many cripples dependent. With our new responsibilities to the men disabled in fighting for us, the point of view must certainly be changed. What some cripples have done, other cripples can do—if only given an even chance.

The industrial cripple should be considered as well as the military cripple, for in these days of national demand for the greatest possible output there should not be left idle any men who can be made into productive workers. With thoughtful placement effort, many men can be employed directly on the basis of their past experience. With the disabled soldiers who profit by the training facilities the Government will provide, the task should be even easier.

This, then, constitutes the charge of patriotic duty upon the employer: To study the jobs under his jurisdiction to determine what ones might be satisfactorily held by cripples. To give the cripples preference for these jobs. To consider thoughtfully the applications of disabled men for employment, bearing in mind the importance of utilizing to as great an extent as possible labor which would otherwise be unproductive. To do the returned soldier the honor of offering him real employment, rather than proffering him the ignominy of a charity job. If the employer will do this, it will be a great factor in making the complete elimination of the dependent cripple a real and inspiring possibility.

Wood and peat, after being partly dried, will yield a gas of 336 to 416 b.t.u., or after removing the CO_2, 450 to 560 b.t.u. The high CO_2 content is owing to oxygen contained in the fuel, but high-temperature carbonization tends to minimize its formation. To improve the product for the consumer a rich gas might be added; coal gas and oil being scarce, acetylene seems the most practical. About 15 volumes to 100 of poor gas would be sufficient, and the spent carbide from the acetylene production would easily form a source of milk of lime to remove CO_2 from the poor gas. Without enrichment wood or peat-gas may be burned with little or no primary air. Wood-gas liquors contain practically no NH_3, but approximately 1% of acetic acid; peat usually gives an alkaline liquor. Tars from both contain from 30 to 50% of H_2O, are poor in benzene and toluene, but rich in phenols. Wood-tars tend to produce stoppages; the heavier woods work best.—'Gas World.'

Japanese metallurgists, at the Hidachi copper works, according to Tetsurow Komakine, recently utilized a sack filled with hydrogen to examine the air currents at great heights above the smelting plant, and it is expected to furnish data to aid in solving the smoke question. At present the smoke is ejected from a stack over 500 ft. high, built on a mountain about 700 ft. above sea-level. It has been found that the gases are not equally dispersed, and that a great proportion may follow certain channels, which vary from time to time. Mr. Komakine further states that the 1000-ft. stack projected for some time at this works is now being built with the idea that the gases will pass out to sea before they fall. He adds that at the Ashio works, the Cottrell electro-static process precipitates the solid particles in the smoke but that additional processes are being developed to deal with the sulphur di-oxide. Neutralization by lime has been practised for years in Japan.

Saline Domes and Other Salt Deposits

By KIRBY THOMAS

The continued academic controversy as to the origin and nature of the so-called saline domes of the Gulf coastal plain gives point to observations on related and similar geologic phenomena in other regions. In southwestern Virginia are found extensive deposits of salt, associated with gypsum, that do not conform, in their geologic relations, to the salt deposits found in other parts of the world. These Virginian deposits are described and discussed in recent articles by George W. Stose, of the U. S. Geological Survey, published in Bulletin 530. The purpose of this discussion is to present sundry general conclusions concerning the Virginian deposits based upon investigations made by me when I was collecting physical data relating to the Union and other sulphur deposits associated with the domes of the Texas-Louisiana region.

My conclusion as to origin differs somewhat from those advanced by Mr. Stose and other investigators; therefore I submit my own idea tentatively. It appears to me that the deposits of gypsum and salt at Saltville, Virginia, are mostly secondary in character and that they were formed through the agency of circulating surface-water, which from the adjacent formations accumulated sulphuric acid from the oxidation of the iron pyrite therein, and dissolved from these or other formations the salt in them. The circulating water was held to these courses by the structural conditions, by the elevation of its sources, and by the overthrust fault. The result was a series of flowing saline and sulphur springs along the fault in favorable localities, the waters of which springs were charged with sulphuric acid and carried salt in solution. The approach of the chemical and salt-laden water toward the surface, and particularly the contact of the acid water with the soft, crushed, and soluble masses of limestone along the fault, resulted in the deposition of gypsum, replacing the limestone, and the precipitation of the salt, either from super-saturation or, as is more probable, because of the disturbance of equilibrium of the acid-salt solution by the chemical reactions noted. This assumption accounts for the limitation of the gypsum and salt deposits to a zone of narrow and varying width extending along the fault-plane and apparently in most instances dipping under the fault. The position of the salt below the gypsum is a characteristic feature of the Saltville district. The reason for this segregation and relation of these salt and gypsum deposits of common and probably contemporaneous origin is not easy to explain, but the likeness to the conditions that exist in the salt domes of the Louisiana-Texas region is significant.

The structural and stratigraphic relations in Virginia and on the coastal plain present noteworthy features of similarity. These can be studied more in detail by reference to the geological sections published in Mr. Stose's articles and in the paper on the domes by G. D. Harris, appearing in U. S. G. S. bulletin No. 429. In Virginia the ascending channel follows a fault; hence the deposits are elongated along the plane of faulting, with a much greater vertical dimension than width. The Virginian deposits are known to extend to a depth of 1200 ft. The shape and extent of the saline domes being roughly controlled by the junction of two fault-planes, they are generally circular or oval.

The presence of sulphur in the domes is due probably to the accidental presence of abundant organic matter in some of the limestone beds that have been affected in the course of the development and growth of the domes. Perhaps sulphur may be found by further exploration in the Virginian locality. Conditions are not unfavorable. The presence of oil in the domes I consider accidental rather than essential, the dome structures acting as a porous and cavernous receptacle with a sealed roof, which has arrested and accumulated the oil in its upward migration in a manner similar to the accumulation of oil in anticlines generally and in the quaquaversals of Wyoming and elsewhere. Similarly some oil has accumulated in the salt deposit, notably at Rogersville, Tennessee.

Interest in the interpretation of the Texas-Louisiana dome-phenomena in its bearing on the discovery of oil is justification for this presentation of the apparent analogy between the Virginian salt deposit and the domes, and I hope that it may incite a discussion that in turn may elicit further facts throwing light upon this subject.

CHARCOAL is recommended by the United States Fuel Administration as a substitute for coal in domestic use. The coal mines are in narrowly constricted areas, and transportation of coal burdens the railroads, but charcoal can be produced in every State. It is particularly adapted to household needs by a little modification of grates and stoves that any intelligent man can make. The Government has fixed the price of charcoal at 20 cents per bushel in carload lots, and at 22 cents in bags. That is equivalent to about $20 per ton. Although its heating power is slightly less than an equal weight of good bituminous coal, it burns steadily and freely without excessive draft, and produces its heat close to the coal, so that no wastage takes place in flame, and it proves far more economical where small fires are desired.

THE OUTPUT of the Australian metal industries for the next 10 years has been contracted. The second largest electro-zinc plant in the world has been erected, and it is reported that Great Britain has arranged to take the surplus of zinc concentrate for the next 10 years. Queensland has an abundance of copper and tin. More coal than gold has been mined there of late, and large deposits of wolfram have been discovered. New South Wales has coal, silver, lead, and gold. Much copper was produced there in 1917, and a plant for the manufacture of copper wire and other goods has been established at Port Kimble, sixty miles from Sydney. In Victoria 40 gold-mining companies have combined to insure more economical production.

REVIEW OF MINING

RENO, NEVADA

Proceedings at the Conference on Gold Mining.

Sixty-eight representatives of gold-producing States and Alaska organized under the name of the American Gold Conference assembled at Reno, Nevada, on August 12. Emmet D. Boyle, Governor of Nevada, presided. A committee, which included J. F. Callbreath, secretary of the American Mining Congress; Bulkeley Wells, manager of the Smuggler Union Mining Co., Telluride, Colorado; E. C. Hutchinson, of the Kennedy Mining & Milling Co., Jackson California; George W. Starr, manager of the Empire Mines Co., Grass Valley, California; H. N. Lawrie, of Portland, Oregon; Fletcher Hamilton, State Mineralogist of California; and J. A. Burgess, superintendent of the United Eastern Mining Co., Oatman, Arizona, drafted a resolution calling for Government aid to gold mining. The Conference was in agreement that the only practical method of relief, because it will not disturb financial conditions, consists in a bounty on the metal as produced at the mines. Other ideas were discussed but dismissed. The bonus will not undermine the basis of currency. The opinion of the conferees was that the increased cost of producing gold is about 40%. Statistics of cost at gold mines are solicited and are being collected for presentation to the War Industries Board. In our next issue we shall publish a full account of the Conference.

Gold production of Nevada continues to decrease this year, according to the mid-year report of the U. S. Geological Survey. Goldfield shows a further decline. The new producers at Midas and Jarbidge in Elko county, Omco in Mineral county, and Manhattan in Nye county promise well. Although silver districts, the increase of this metal at Tonopah and Virginia City results in a larger output of gold. The old National district yielded some rich ore.

PLATTEVILLE, WISCONSIN

Zinc Mining, Prices, and Production During July.

Operating conditions in the zinc-lead districts of Wisconsin were ideal during July, and conducive to at least normal production of ore; but a rather poor comparison with this month in former years. There were many factors responsible for the reversal of form. Markets for zinc ore were fairly firm and steady, though not as satisfactory as mine-owners desired; but demand at times was wholly indifferent. The labor situation was further aggravated by the exodus of hundreds of drafted men, many of whom were experienced miners. The region is one of the finest agricultural districts in the Middle West, and many farmers engaged in zinc-ore mining between planting and harvest have returned to their farms. Considerable labor was imported into the field from large commercial centres, but employers complained about the efficiency of the new help. A genuine scarcity of coal was partly responsible for the closing down of several low-grade producers, a situation that may be intensified as the season passes. A big reserve of zinc concentrate from June, conservatively estimated at not less than 10,000 tons, also acted depressingly. At the end of July this reserve was 12,000 tons. Notwithstanding these numerous drawbacks, operators were optimistic regarding the future zinc mining, and anticipated prosperity later in the year.

The month opened with premium grades of blende from refining-plants selling on a base of $75 per ton, 60% assays, for the product sold to sheet-metal manufacturers. Refiners sought this market keenly, and with fair results, most of the refinery product going in this direction. Concentrate assaying 60% metal for spelter manufacturers sold on a base of $52 most of July, at one time reaching as

MAP OF THE UNITED STATES SHOWING SITUATION OF IMPORTANT GOLD-PRODUCING CENTRES. THE MAIN DISTRICTS ARE ADJACENT TO THESE. BISBEE AND BUTTE ARE INCLUDED AS THEY YIELD LARGE QUANTITIES OF GOLD FROM COPPER ORE. THE MINTS ARE AT SAN FRANCISCO, DENVER, AND PHILADELPHIA.

high as $55. The latter price held for about a week, then receded to the more normal quotation. The range at one time dropped to $47.50, on second and inferior grades, but the better prices were maintained from a sort of mutual understanding between buyers and sellers. Low-grade producers found the Mineral Point Zinc Co. their most certain outlet. Prospecting was at a low ebb most of the period. Several mines shut-down indefinitely, while others closed for a time and operating with electrically-driven plants resumed. Only one new concentrator was started, At one or two points old plants were dismantled, the material being sold and shipped out of the field.

Lead-ore producers fared well. Prices opened in advance of $90 per ton, 80% metal content. Gains in the offerings were made until near the end of the month the price had advanced to above $100. Sellers felt that prices must go higher, and held to their product. Shipments were irregular. The reserve is estimated at not less than 2000 tons, some of which has been held over a year.

Shippers of pyrite maintained a normal tonnage, which came almost entirely from refinery plants. Shipments kept pace with production, and there was no reserve at the end of the month. Prices showed fair gains in favor of sellers in a position to accept open-market offerings. Two new sulphuric-acid plants, to be operated in connection with the Skinner roasters at New Diggings and the National Separators at Cuba are to be erected. The Leonard Construction Co. of Chicago received the award for both contracts, the terms calling for completion in 90 days, at a cost of $250,000 to $300,000 each.

For the first time this year there was a demand for zinc carbonate ore. Large deposits of this class of ore are available in the upper ground, and can be cheaply mined. A fair market would stimulate production greatly.

Shipments from mines to refiners in the field and from the smelters were made from July 1 to 27, inclusive, totaling 14,137 tons of zinc, 646 tons of lead, and 3200 tons of pyrite.

VICTORIA, BRITISH COLUMBIA

Labor Troubles.—Ore-Testing Plant.

Silverton.—Labor troubles, which threatened to disorganize work in the Slocan-Silverton districts, have been averted largely through the efforts of J. D. McNiven, Deputy Minister of Labour, in bringing employers and employees together. Near Silverton, among the better-known properties affected were the Standard, Van Roi, Hewitt, and Galena Farm, while both in this area and near Sandon there were a number of smaller mines which would have been tied-up if the men had left work. The unions at Sandon and Silverton, having a membership of between 600 and 700, first demanded a straight increase of 50c. per day, an 8-hour day for all surface workers—the same as those employed underground, recognition of the 'closed shop,' and provision for the collection of union dues by the companies. The result was the concession by employers of an all-round increase of 50c. per day. This amount is to be applied in full to those employees who board themselves, while those boarding at company houses will get an additional 25c. in cash and a similar amount will be added to their board account. The condition, therefore, now is that miners, mechanics, mill-men, concentrators, etc., are drawing $5, while shovelers, etc., receive $4.50.

Victoria.—Reference has been made in 'The Mining Summary' to the intention of the Dominion government to establish an ore-testing mill in British Columbia. It was thought that an appropriation of $40,000 would be made at the last session of the Dominion Parliament at Ottawa. This action, however, was not taken, so that the plant will not be started this year; but assurances have been received that financial support will be forthcoming in 1919.

AUSTIN, TEXAS

The Importation of Laborers From Mexico.

Laborers are being brought across the Rio Grande in increasing numbers each day and distributed throughout Texas, even to more remote parts of the country. As a source of labor supply for the farms, mines, railroads, and war industries of the United States, Mexico can be drawn upon to the fullest extent. Of the 15,000,000 population of the republic, approximately 12,000,000 are of the peon or working class, most of whom are without steady employment and lead a hand-to-mouth existence. Under the new immigration regulations many thousands of the laboring element of Mexico have entered the United States during the last few weeks. Employers of large forces are interested in keeping up with the changes that have been made in the restrictions and regulations governing the importation of Mexicans. A statement just issued by E. P. Reynolds, U. S. Immigration Inspector on the Rio Grande border, says: "The latest changes provide for Mexican laborers to be imported under contract for the purpose of engaging in mining of any and all kinds, or to be employed in the performance of common labor in connection with construction work being done by or for the United States government. Another important change is that employers are no longer required to deposit in the postal savings bank 25c. per day out of each contract laborer's wage, there to remain until such laborer returns to Mexico. These are all the changes in the regulations governing the admission of Mexican laborers which have been recently made, and otherwise the regulations are in full force and effect. It is now permissible to bring in Mexican laborers under contract, and without regard to the head tax and illiteracy provisions to engage in the following occupations only: strictly agricultural work, railway-maintenance work, mining work, or in construction work being done by or for the United States government. If the laborers so brought in, are afterward found engaged in any other kind of work, they are subject to immediate arrest and deportation. In order to obtain a waiver of the head tax, illiteracy test, and contract labor provisions of the immigration laws, the prospective importer or employer of labor must first go to the U. S. Employment Officer located nearest the place where the prospective laborers are to be employed, and there secure from said United States Employment Officer a letter authorizing the importation of a specific number of laborers, and for a specified purpose. This letter must then be presented to the immigration officers at the 'port' of entry, and the employer or his duly authorized agent must then bring in his laborers from Mexico, or at least meet them at the port of entry and there take charge of them. Before the employer can be permitted to import foreign labor under these exceptions he must first execute a contract with the United States, binding himself to keep these laborers engaged either in agricultural work or in railway maintenance work, or mining work, or in construction work being done by or for the United States government. He must also bind himself to report monthly to the inspector in charge, immigration service at the port of entry, the names of all such aliens together with their identification card number and their occupation, and if they leave his employ he must report such fact immediately. The employer or importer must also furnish photographs and printed identification cards covering all such laborers admitted. No importations are to be permitted under our instructions unless the importer first executes the above mentioned contract, and first receives authority from the appropriate United States employment officer. Also, the employers are responsible for the return of their laborers to Mexico at the expiration of their term of employment without expense to the Government."

During the first half of 1918 some copper ore was mined from the 'Red Beds' of Foard and Knox counties, of Texas.

ALASKA

Cordova.—In Bulletin 675 of the U. S. Geological Survey, Fred H. Moffit and R. M. Overbeck describe the upper Chitina valley and the igneous rocks. The area of this region is 1200 square miles. As the reconnaissance surveys of the developed districts in the Copper River basin were completed, the work has been extended into adjacent areas. The upper Chitna was surveyed in 1915. According to Alfred H. Brooks in the preface, copper-bearing rocks occur in this region. The formations from which the Nizina placers derived their gold occur in this area. On the other hand, no mineral deposits of proved value have yet been exploited in the upper Chitina basin. However, little prospecting has yet been done.

Juneau.—Alaska Gastineau during July treated 74,830 tons of $1.319 ore. The recovery was 82.03%. Returns for the year are as under:

Month	Tons	Value per ton
July	74,830	$1.319
June	82,600	1.250
May	101,200	1.114
April	125,435	1.148
March	150,093	1.114
February	140,305	0.934
January	179,300	0.903

Port Chatham.—An old stamp-mill is being erected by the Whitney and Lass interests at their chrome mine near this place.

Treadwell.—The Sheep Creek and Nugget Creek hydro-electric plants of the Treadwell group have a large surplus of power, so part of it is now used in generating steam in an 'electric boiler.' This is 30 in. diameter and 108 in. high, standing on end. The voltage is 2300, single-phase, alternating current. A steel shaft 6 in. diameter is suspended vertically in the centre of the boiler, insulated from the shell, except from the circuit completed by the water. The path of the current is first from one line through the centre shaft, then through the water to the boiler-shell, then on to the other line. There are no coils at all. Little attention is necessary. A silimar but smaller boiler is being fitted at the Alaska Juneau plant.

ARIZONA

The mines and smelters of Arizona were gradually regaining their normal rate of production during the first months of 1918, and toward the middle of the year they had considerably surpassed it, according to V. C. Heikes of the U. S. Geological Survey. A larger output of gold, silver, and copper may be expected this year, but less lead and zinc.

Jerome.—Following is the building program that the United Verde Copper Co. is pledged to the U. S. Department of Labor to carry out: Emergency and pneumatic hospital at Clarkdale, ready about Thanksgiving; apartment building to be built here, of thirty-three 3 and 4-room apartments, ready in February next; eight patio groups (six 3-room houses providing rooms for 48 families), ready in January, at Clarkdale; twenty 5-room houses with two sleeping porches to be built at Clarkdale, ready in January; completion within 60 days of old hospital building at Jerome, furnishing room for 60 single men; twenty 4-room houses to be erected at Jerome, depends on railroad construction for time of completion; steam-shovel camp, four 16-room bunk-houses (concrete), for 64 single men, within 6 months; and the Clarkdale club-house, for which plans are being prepared.

Walker.—The Black Diamond company has purchased a new steam-driven drilling plant and compressor. Plans for sinking 500 ft. are completed. It is estimated that $100,000 of ore is blocked out above the 200-ft. level.

The Bannie mine's new compressor plant is working well, a carload of ore assaying 21% copper, 20 oz. gold, and 12 oz. silver, is being shipped this week.

The Mud Hole Gold Mining Co. has been incorporated by W. C. Lacey and William Casey, to take over holdings and mill of the old Mud Hole company. The capital is $1,000,000, shares $1 par. The mill is being overhauled to treat a large quantity of low-grade gold ore in old workings. The Mud Hole produced $325,000 in high-grade ores above the 300-ft. level, previous to labor troubles 12 years ago.

The Amulet silver mine recently made a shipment of ore carrying 200 oz. per ton, and some gold. The General Mines Co. is working this property, C. N. Brown being in charge.

The Virginia silver mine is opening well. The owner, W. A. Crank, states that a trial shipment returned 82 oz. silver and 27% lead. Sinking is under way.

The Star molybdenum mine, owned by John T. Burris, was the scene of much excitement recently when native silver was found.

The 97 group of three claims was sold this week by W. A. Crank and C. J. Kerr to a St. Louis capitalist, who will increase the output of molybdenite, which assays from 1.8 to 3% across a 12-ft. vein on the 97 claim proper.

CALIFORNIA

Dedrick.—Statements published in the daily press to the effect that the Globe mine near here was shut-down and that the plant was to be sold are incorrect. Only a few men are working, but development continues. H. M. Hall of San Francisco is owner.

Folsom.—Chrome mining in the Negro Hill district, 7 miles from here, is said to be employing 100 men. The weekly output of all operators is three carloads of ore. Eight auto-trucks are used to haul it to rail.

Grass Valley.—Mine-owners in this district selected G. J. Rector, president of the Nevada County Bank; J. B. Stapler, superintendent of the Champion mines at Nevada City; and W. E. Wright, secretary of Nevada City Chamber of Commerce to attend the gold conference at Reno on August 12. A. B. Foote and G. W. Starr also attended.

Junction City.—From this place in Trinity county 3000 ft. of 36-in. steel pipe, long in use by the Cse Fse Hydraulic Mining Co., is being trucked to the Singletown region of Shasta county, a distance of 110 miles, where it will be used by the Northern California Power Co. This pipe was laid in 1882, when it formed a siphon for this French company. When the Cse Fse shut-down for good in 1898, the pipe ceased to serve any useful purpose. For twenty years it has lain exposed to the weather, yet it is in good condition. The Northern California Power Co. will use the pipe to replace wooden stave-pipe at its Volta power-house near

Shingletown, and to make a pump-line at Baldwin creek, where it is pumping water from the creek to its ditch feeding the power-plant at Coleman. The company expends 200 hp. in pumping water that will generate 1000 hp. at its Coleman plant.

Castella.—Neeley brothers' chrome mine, 22 miles west over the divide in Trinity county, is keeping three auto-trucks going hauling chrome to Castella. Seven more trucks are to be employed at once. Edward H. Martin is superintendent with 25 men.

Markleeville.—Copper properties in this district of Alpine county have been examined this summer by engineers representing Eastern capital. Lack of rail transportation is a drawback to development. Some high-grade copper and silver deposits are being mined on a small scale.

San Luis Obispo.—Chrome mining in this county is now an important industry, according to the 'Daily Telegram,' published here. The Goldtree station is shipping 1500 tons monthly, also some from Santa Margarita and San Luis Obispo. About 300 men are employed in mining and shipping the ore. The best deposits are in the range west of Cuesta Pass, extending up the coast to San Simeon. The large producers are the Pick & Shovel, Trinidad, London, and Castro, originally worked years ago. Others are the Union and Pierce on San Bernardino creek. The Pick & Shovel is worked by tunnels. Thirty-five men are employed, in charge of G. W. Nicholson, who is also at the Trinidad. A 20-ton concentrating plant is being erected. Ore is hauled to rail at Goldtree. Ore in the Trinidad is found at a depth of 200 ft. on the incline. Fifteen men are at work. The London mine of W. C. H. Dibblee and P. A. H. Arata is operated by tunnels. A small mill is to be erected. The California Chrome Co. operates the Castro mine, all by open-cut method. A mill concentrates the low-grade ore.

Weaverville.—The Lagrange mine, once the greatest hydraulic mine in the world, has been shut-down for good.

GIANT AT WORK AT LAGRANGE MINE, NOW SHUT-DOWN.

All movable plant is to be sold. The War has hastened the end, which would have come in a few years. One trouble was the proximity of the main reservoir to the workings. To alter this would cost a large sum. Rails for riffles may be difficult to secure. The company has just made its final clean-up, said to have been a good one. Twenty-three miles of flume, ditches, and pipe convey water from far up Stuart's fork to the mine. The pipe will be sold, but the valuable water-right will be preserved and may be utilized in generating electric power. The Lagrange, situated on Oregon Gulch mountain, four miles west of Weaverville, has been in operation for forty years. A whole mountain has been washed down. The anti-debris law that closed nearly every hydraulic mine in the State a few years ago made no difference to Lagrange, as there is no farming land down Trinity river for the debris to damage. The closing of the mine is a severe blow to Weaverville, which derived a good deal of trade from the 40 men usually employed in or around the mine.

COLORADO

Cripple Creek.—Gold output of the district during July totaled $912,110, from 96,710 tons of ore. Dividends amounted to $272,000.

Lake City.—The old Hidden Treasure mine, of great reputation in early days of Gunnison county and later known as the Oriental, has been taken over by the McCarthy-Hidden Treasure Mining Corporation of Omaha and Council Bluffs. There has been several thousand feet of development done on seven levels. Ore is conveyed 3800 ft. to the mill by a Bleichert aerial-tram. The length of the cross-cut tunnel is 3700 ft. from portal to vein. The average width of vein is 30 in. Concentrate assays $90 to $100 in silver, lead, and gold. The mill includes a crusher, rolls, jigs, ball-mill, Wilfley tables, and a flotation plant. Three Callow tanks were put in recently. Water and steam combined has a capacity of 1000 hp. The machinery comprises a 50-kw. direct-current generator for hoist, 75-kw. alternating-current generator for mill, 100-kw. alternating-current generator in reserve, and a 24-drill Ingersoll-Rand air-compressor driven by a 150-hp. Pelton water-wheel. Waugh drills are used in the mine. Officials are E. L. Thomas, Omaha, president and manager; T. A. O'Brien, superintendent of the mine; E. F. Gustafson, superintendent of the mill; W. A. McCarthy, electrician; and R. F. Stenson, office manager.

Gunnison.—The mineral holdings of the Searchlight Oil & Mining Co. are in the Goose Creek district, extending from Spencer to the Cebolle river, and consist of 10 claims, a mill-site, tunnel-site, and water-right for the immense projected reservoir on the river. At a point 75 ft. above the river the Smoot or main tunnel is in 150 ft., and is being driven toward a chimney, the outcrop of which is 368 ft. above the tunnel. A large body of copper and silver ore is expected to be there. The Searchlight company also owns the Smoot gold and sulphur mine, one mine south of the Cebolla river. Two other claims of the company are four miles from the Smoot entrance, in a direct line with the producing Iron Cap and Copper King mines. Shafts are down on a rich copper and gold shoot 10 ft. wide. Arthur G. Dominy of Boston is president; Robert E. Magee of Gunnison is general manager.

The Anaconda company, 1½ miles north-east, has developed its copper ore to a depth of 200 ft., and is shipping high-grade material.

Workings of the Headlight company are down 200 ft. in a wide lode. This property is owned and operated by a Cincinnati brewing firm, which purposes erecting a smelter.

Ohio.—On Volunteer mountain in Gunnison county less than four miles from this place are the 800 acres of the Carter Mines Co., with W. D. Murdie in charge. A 9000-ft. tunnel has been driven to an 1100-ft. raise of the shaft-workings of the old Volunteer mine, originally sunk on a strong vein of copper-iron sulphide ore between granite walls. With the present scarcity of labor the output is only 20 tons daily. A stream and reservoir supplies water to drive three Pelton wheels. One Pelton operates a Westinghouse 17-kw. d.c. dynamo for electricity used in the workings. Another 150-hp. wheel drives the Ingersoll-Rand compressor, generating 130 lb. pressure and operating 10 Leyner drills. A commodious mill building, situated near the tunnel portal, contains ore-bins, automatic-feeders, a 9 by 15-in. Blake crusher, 20 stamps, and 5 Wilfley tables. The stamps and tables are also operated by a 100-hp. Pelton wheel. Eleven levels, 100 ft. apart, have been driven 300 ft. north and south each from the raise, which is of four compartments, 4½ by 4 ft., equipped with a cage. Ore is sent down chutes on one side.

IDAHO

Though much is heard concerning increased cost and shortage of labor in 1918, many of the big mines of Idaho continue to increase their shipments, according to C. N. Gerry, of the U. S. Geological Survey. The total yield of metal, however, has probably fallen off in the first half of 1918. The increase in the price of silver does not offset the decrease in the price of lead, for lead is Idaho's main output. Ore and concentrate from the Coeur d'Alene district, including lead, zinc, and copper material, were shipped at the rate of about 44,000 tons per month during the first half of 1918.

Wallace.—Miners at the Morning and Gold Hunter mines quit work on August 6. A majority of the strikers were earning $7.65 to $11.65 per day on contract work. They struck for an eight-hour day from portal to portal of the mines, a pay-day twice a month, and a Sunday off on pay once each month. On the 8th it was reported that the men had resumed work pending settlement.

The Success zinc-lead mine has been unwatered to the 1600-ft. level, after being flooded for three months. Development is to be continued at 1500 and 1600 ft. It is said that more favorable terms have been arranged with the smelter.

MISSOURI

Joplin.—Production of the region last week was 8366 tons of blende, 140 tons of calamine, and 1667 tons of lead. These averaged $49, $35, and $101 per ton, respectively. The value was $591,237, making $14,781,288 for 31 weeks. Missouri contributed $111,336 to last week's return.

MONTANA

Reports of the production of copper in Montana in 1918, according to V. C. Heikes, U. S. Geological Survey, indicate that the State will this year make an output equal to that of 1916, which was more than 352,000,000 lb. The output in 1917 was about 278,000,000 lb. There was much interest in the mining of lead ore in Montana in the first half of 1918, especially in the Helena and Rimini districts. The increase in the output of copper assures a corresponding increase in the output of gold and silver. There is every indication that the output of zinc in Montana in 1918 will be larger than in 1917, though the price was lower during the first part of the year.

Big Timber.—Mines of the Boulder River Chrome Co., on the Boulder river, 35 miles from this place in Sweet Grass county, are reported to have been sold to Oscar Rohn, general manager for the East Butte Copper Co., for a large sum. It is said that the Boulder River deposits are the only workable ores in the United States outside of California and Oregon.

Butte.—On the 825-ft. level of the Tuolumne company's Main Range mine, on the east side of the district, a wide shoot of 4.7% copper and 12.5 oz. silver ore has been opened. This is supposed to be the downward extension of the ore at 700 ft. Sinking of the main shaft is to be resumed soon. This company is employing 100 men at its properties. Net earnings in July were $5000. Ore shipments are from 100 to 150 tons daily.

The Butte East Slope Mining Co. has published its prospectus. The capital is $500,000, shares $1 par. E. P. Lomas is president; Martin Flyth, vice-president; and C. B. Lomas, secretary-treasurer. The property consists of 5 claims in Jefferson county, just east of Columbia gardens in the Butte district. Two veins are said to carry gold and silver near the surface, and copper at 160 ft. The shaft is to be sunk to 500 feet.

Libby.—The Lukens-Hazel Mining Co. is to erect mining and milling machinery, and a hydro-electric plant, said to cost $150,000, of proposals are carried out. The mine contains a large quantity of gold-silver-lead ore. The directors are C. E. Lukens, president and treasurer; John H. Town, vice-president; Williamson Jennison, secretary; H. L. Faust of Libby and Oscar Nordquist of Spokane.

Saltese.—The Tarbox mine in the east Coeur d'Alene region, is opening extremely well. The main shaft is down 800 ft., and below this level a 200-ft. winze is being sunk. On the 800-ft. level a large lead-silver-zinc vein has been opened, estimates giving 110,400 tons between this and the 600-ft. level. A 100-ton mill is being considered. The property has extensive water and timber rights.

NEVADA

In 1917, mines of Nevada produced metals valued at $53,000,000, the greater part of which was for copper, according to V. C. Heikes, of the U. S. Geological Survey. The output of copper will be considerably greater in 1918 than it was in 1917 if the present rate of shipping and smelting is maintained, but the output of lead and of zinc will probably be much less, as shipments from the principal centres have been greatly reduced. The output of gold has been decreasing for several years, and the output of silver also decreased in 1917. Shipments of bullion, ore, and concentrate, during the first six months of 1918 indicate that the production of gold continued to decrease, though every effort was made to market silver ore and bullion on account of the advance in the price of silver. The promising gold fields are at Midas, Manhattan, Omco, and Jarbidge. The silver districts of Rochester, Tonopah, and Virginia City are making good yields.

MILL OF ELKORO MINES CO., AT JARBIDGE, NEVADA; A SUBSIDIARY OF THE YUKON GOLD COMPANY.

Ely.—The Consolidated Coppermines Co. has issued its report for the year ended December 31, 1917, and for four months ended April 30, 1918. The general manager is Robert Linton; general superintendent, H. S. Munroe; and consulting engineer, E. F. Gray. The property was examined by E. J. Collins of Duluth, Minnesota, in April and May 1918. The total value of metals produced in 1917 was $2,473,439. Current assets on April 30, 1918, were $2,916,459, and liabilities $1,344,817, against $2,936,240 and $1,163,017 at the end of 1917..

The Norris-Brooks mine yields sulphide concentrating and direct-smelting sulphide ores, and the Alpha direct-smelting oxide ore (8%). In the former 23,908 ft. of work was done. The branch-raise system of caving is in use. The Alpha has been opened by a 12 by 19½-ft. shaft, 1440 ft. deep. Reserves in all mines total 20,092,800 tons, averaging 1.31% copper. During 1917, 343,120 tons of ore produced 9,801,252 lb. of copper, 7031 oz. of silver, and 2545 oz. of gold. The re-modeled Kimberly mill dressed 145,466 tons of this ore, averaging 1.69% copper. The ratio of concentration was 12.2 into 1, and recovery 73%. The Nevada Consolidated mill also handled 174,056 tons of 1.36% ore, the ratio being 10.12 into 1, and recovery 59.86%.

During the first four months of 1918, 133,635 tons yielded 4,601,885 lb. of copper, 5345 oz. of silver, and 1112 oz. of gold. Lessees extracted ore containing 131,215 lb. of lead and 109,510 lb. of manganese.

Hornsilver.—The companies and lessees in this district are employing 100 men. The Silvermines mill is treating ore from a number of properties. The principal operators are the Silvermines, Orleans, Nettie L., Silver King, and American.

Manhattan.—The White Caps main shaft is to be sunk 150 ft. below No. 5 level. All timber is on the ground. A hoist on No. 5 will permit of sinking without delaying ore extraction.

NEW MEXICO

Lordsburg.—The Great Eagle fluorspar mine, at Red Rock, 30 miles north of here, is said to be under negotiation for sale for a large sum. Canthers and Connors are owners.

OKLAHOMA

Miami.—Following the suggestion of James McNichols of the Oklahoma Engineering Co., an ore exchange will probably be created here. The idea is to trade in warehouse receipts for zinc and lead concentrates stored but not sold. Local bankers are said to favor the arrangement, as they can lend money on warehouse receipts. The 'ore pit' will be held in the lobby of the Hotel Miami.

Picher.—Production of the districts last week totaled 6509 tons of blende and 1348 tons of lead, valued at $460,401.

St. Louis.—The Jupitor 200-ton mill of the Huttig Lead & Zinc Co. was burned on August 3. The loss is over $80,000.

UTAH

Advance figures of the U. S. Geological Survey, through V. C. Heikes, of the mine production during 1917, have been issued. A comparison of the past four years is as under:

	1917	1916	1915	1914
Producers	334	318	234	214
Ore treated, tons	15,358,481	13,920,643	10,451,445	8,544,014
Gold, ounces	162,306	172,938	174,591	157,961
Silver, ounces	13,479,133	13,253,037	12,313,205	11,154,916
Copper, pounds	246,674,153	240,275,222	187,671,188	152,034,002
Lead, pounds	178,521,958	201,490,075	199,967,437	171,323,137
Zinc, pounds	21,286,871	29,572,528	24,292,240	15,989,267
Value	$99,328,155	$89,268,684	$55,105,070	$37,151,253

Salt Lake county was far ahead of all others in all metals, accounting for 75% of the total value. Juab followed with 10%. Beaver and Tooele counties have 60 and 61 producers, respectively, yielding $2,180,651 and $3,253,492.

Alta.—A new wage-scale has been adopted in the Alta-Cottonwood districts. The average increase is 50c. per day. The lowest wage is $4.50—for laborers—and highest $5.50 for machine-drillers. Board is up 10c. per day to $1.35.

Eureka.—The new shaft of the Chief Consolidated is to be lined with concrete instead of timber. This is the first concrete shaft in Utah. The new pumping plant at the other mine is working well.

Lark.—Part of the Ohio Copper Co.'s mill here was burned on August 10, the damage being $75,000.

Tintic.—Ore and concentrate production of this district in July totaled 620 carloads, or about 24,800 tons.

WASHINGTON

Early in 1918 the mines in Washington were continuing shipments of ore at the rate that prevailed in 1917, according to C. N. Gerry, of the U. S. Geological Survey. The gold output for 1918 should be normal; silver will show no great increase; while copper and lead should report increases.

Northport.—The Electric Point company is shipping a car of lead ore daily. The shaft is to be sunk to 1000 ft., where sulphides are expected.

Spokane.—Announcement of a gold convention to be held here soon has been made by the Northwest Mining Association. The purpose is to gather and disseminate information in support of the Federal government's request to stimulate the production of gold throughout the country. The date and features of the convention will be announced shortly.

The gold conference mentioned above is to be held here during the week of September 2 to 7. It will be held under the auspices of the Northwest Mining Association, whose committee consists of F. A. Ross, A. W. Boyd, F. C. Bailey, and Sidney Norman.

Inability to secure mining machinery is seriously retarding the development of many properties in the North-West. The demand on machinery houses for war purposes has depleted stocks, and factories are far behind on orders. Sometimes mining men, despairing of having orders filled, scout around and find used machinery which is available. A recent instance occurred in the Oroville district, when the Oroville Copper Co. wanted equipment. The manager found what he wanted at the old Republic mine, at Republic. He purchased a 75-hp. compressor, motor, and receiver, at a big saving. The machinery had been used only a little over a year.

CANADA

British Columbia

Britannia.—At the Britannia mine the new mill is reported to be dressing between 2200 and 2300 tons of ore per day. It is reported to be making a recovery of between 94 and 95%. The Howe Sound Co. has opened what is termed Mammoth bluff as a quarry, marking the commencement of the mining of Britannia mountain. The greatest problem in connection with operations is the shortage of labor. There now are only approximately 850 men on the payroll, against 1000 normally. The company is planning to place its entire system of ore transportation underground.

Kaslo.—B. F. Millard of Seattle, who has purchased from A. G. Larson of Spokane and associates, manganese properties here, is resuming operations with 30 men. He is erecting a drying-plant for the ore, to reduce freight charges on the product, which is shipped to Pennsylvania. In some lots shipments contained 40% water. There is 2000 tons available, estimated to average 42 to 45% Mn.

Trail.—The smelter here has received 200,237 tons of ore in the first seven months of 1918, against 200,145 tons in 1917. During the second half of July there was reduced 7614 tons.

Tulameen.—With further reference to prospecting for

platinum, it is authoritatively reported that the Munitions Resources Commission of the Dominion government has a drill at work on the Saskatchewan river and another on the Peace river. The Tulameen river is to be thoroughly tested, two drills being on the way. It is understood that there already are two drills at work in the placer ground of this river. Eugene Poitevin, a mineralogist attached to the Department of Mines at Ottawa, has returned after spending a few weeks at Olivine mountain, near Tulameen. The gold and platinum has not been carried a great distance, and it is suggested that the Government place a diamond-drill to prospect some of the outcrops on the mountain. There are many prospectors camped along the Tulameen river near the mountain and a number of claims have been staked.

Windermere.—The mines of this district will have a busy season ahead of them. Several have shipments on hand ready for release as soon as roads permit. The Hidden Treasure, which was sold last fall to a Calgary syndicate, will be opened on a more extensive scale. A carload of high-grade copper and silver ore awaits treatment.——The Lead Queen, No. 3 creek, intends shipping as soon as the season opens.——The Isaac, on Frances creek, has several cars ready.——On the dump of the Sitting Bull group, Boulder creek, there is a quantity of high-grade galena.

Manitoba

Falcon Lake.—Tungsten deposits near here are described in the 'Canadian Mining Journal' of June 1 by J. S. DeLury. The area is north-west of Shoal lake, near the Ontario boundary, and was prospected for gold several years ago. Molybdenite was investigated there in 1917. The district is midway between the main line of the C. P. R. line and the Greater Winnipeg Water District Railroad. By good canoe routes and trails the prospects can be reached from either line in a half-day. Rocks consist mainly of ancient schists and a later intrusive granite series. Pyrite, pyrrhotite, chalcopyrite, arseno-pyrite, sphalerite, and galena occur in the rocks. The zones that carry the scheelite should be fairly continuous. Epidote (silicate of alumina) is the characteristic gangue mineral. The scheelite is pure white, but sometimes it is pale pink or red. So far, the tungsten ore found is confined to a band in the schist parallel to the granite contact. This band is 3 miles long and ½ mile wide, and has nearly all been staked; but there is no reason why the tungsten-bearing zone should not have greater limits. Development of the molybdenite deposits is considered promising.

Ontario

Cobalt.—Dividends paid by local companies during the first half of 1918 totaled $2,475,055, as under:

Coniagas	$200,000
Kerr Lake	300,000
LaRose	30,000
Mining Corporation	727,271
McKinley-Darragh	202,293
Nipissing	900,000
Penn-Canadian	40,491
Temiskaming	75,000

Porcupine.—Dividends paid by local companies during the first half of 1918 total $607,028. The McIntyre paid $361,028, and the Hollinger $246,000. The Hollinger pays 1% on August 12. This is equal to $246,000.

Yukon

Mayo.—Rich silver ore is said to have been opened in the Lookout Mountain mine of J. Pickering and others. Several other claims in this district are reported as having good indications. The Silver King, 30 miles away, has been a large producer.

KOREA

Unsan.—The Oriental Consolidated paid 25c. per share on July 26. The June clean-up yielded $144,000.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

David T. Day is here.

L. D. Ricketts was here last Monday.

Tom Lee Ball has enlisted as a pilot in the Naval Aviation Corps.

T. M. Lowry, Major in the British army, has been awarded the D. S. O.

F. M. Manson, of the Western Ore Purchasing Co., Nevada, is here.

Charles Lehman has left Naltagua, Chile, and has returned to England.

Robert A. Watkins, editor of the 'Arizona Mining Journal' passed through San Francisco.

Courtenay De Kalb, after attending the Gold Conference at Reno, has gone to Ely, Nevada.

A. P. Watt has been elected to membership in the Mining & Metallurgical Society of America.

Allen H. Rogers, of Boston, spent the week in San Francisco, on his way to British Columbia.

C. A. H. DeSaulles succeeds **L. G. Eakins** as manager in Colorado for the A. S. & R. Company.

Charles W. Stimpson and **E. Shores**, of Salt Lake City, were in San Francisco for a few days.

Lloyd C. White, mill superintendent for the Mountain Copper Co., was in San Francisco this week.

C. H. Brainerd, of the Brainerd, Fairchild Engineering Co., is examining zinc properties in Oklahoma.

L. J. Mayreis has resigned as assistant-manager for the Burma Mines company and is on his way to New York.

C. W. Purington and **Millard K. Shaler** have been appointed consulting engineers to the U. S. Bureau of Mines.

A. E. Drucker has completed a series of leaching and electrolytic zinc investigations for the Consolidated Interstate-Callahan Mining Company.

K. B. Thomas, superintendent of the sulphuric-acid department of the Calumet & Arizona Mining Co., is taking a short holiday in San Francisco.

R. Arthur Thomas has resigned as resident manager of Dolcoath, becoming managing director. The company is advertising for a resident manager.

Albert R. Ledoux has been appointed chairman of the Chemical Alliance Committee on the Production, Distribution, and Control of Sulphur Minerals.

L. R. Boyer, formerly with the U. S. Bureau of Standards, has joined the organization of E. & T. Fairbanks & Co., scale manufacturers, St. Johnsbury, Vermont.

D. R. Thomas has resigned as assistant-manager for the Moose Mountain, Ltd., and is now advisor to the American Cyanamid Co., at Niagara Falls, Ontario.

R. Williamson has been made general manager of Block 10 Misima Gold Mines, at Missima, New Guinea, replacing **O. B. Ward**, who resigned owing to serious illness.

H. W. Aldrich has resigned from the Anaconda Copper Mining Co. to become assistant general superintendent for the Inspiration Consolidated Copper Co., at Miami, Arizona.

L. G. Eakins, general manager of the Colorado branch of the A. S. & R. Co., has resigned his post at Denver and will serve as consulting metallurgist to the smelting company in New York. He is now in San Francisco.

M. R. Park, Flight-Commander of the Royal Flying Corps, has been awarded the Croix de Guerre and the Military Cross for exceptional service in France. He is the youngest son of James Park, of New Zealand, well known as a mining geologist, and the author of several works on assaying, geology, metallurgy, and mining.

THE METAL MARKET

METAL PRICES

San Francisco, August 13

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26 00
Copper, electrolytic, cents per pound, in small quantities	27 35
Lead, pig, cents per pound	8.30— 9 30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

The Mint at San Francisco has been authorized to receive crude or manufactured platinum for Government purposes.

ORE PRICES

August 13

Antimony, 45% metal, f.o.b. California, per unit	$1 10
Chrome, 38 to 48%, California, per unit	$1.25—$1 50
Fluor-spar, 85% CaF_2, f.o.b. shipping point, or San Francisco per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—$8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 54%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$24

In 'Mineral Foot-Notes' for July-August it is stated that 90 to 95% molybdenite, entirely free from impurities, is worth $1.50 per lb., and that the price approximating $1 per lb. is for offerings of lower-grade product, for which there is practically no demand.

EASTERN METAL MARKET

(By wire from New York)

August 13.—Up to the time of going to press our weekly metal telegram had not arrived. As most of the prices are fixed, there can be few changes.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date		Average week ending	
Aug.	7	July 2	23.50
"	8	" 9	26.00
"	9	" 16	26.00
"	10	" 23	26.00
"	11 Sunday	" 30	26.00
"	12	Aug. 6	26 00
"	13	" 13	26.00

Copper outputs of some of the mines in July were as under:

Mine	Pounds	Mine	Pounds
Anaconda	25,400,000	Phelps Dodge	14,277,057
Arizona	4,000,000	Miami	4,793,000
Calumet & Arizona	4,214,000	New Cornelia	3,900,000
East Butte	2,076,000	North Butte	1,750,000

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	....
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
July	31	June 25	7.82
Aug.	1	July 2	7.90
"	2	" 9	7.99
"	3	" 16	8.05
"	4 Sunday	" 23	8.05
"	5	" 30	8.05
"	6	Aug. 6	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10 93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	....
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46 65 pence per ounce (925 fine), calculated at the current rate of exchange.

Date	New York, cents	London, pence	Average week ending	
Aug. 7	99 62	48 81	July 2	99.50
" 8	99.62	48 81	" 9	99 62
" 9	99.62	48 81	" 16	99.62
" 10	99 62	48.81	" 23	99.62
" 11 Sunday			" 30	99.62
" 12	99 62	48 81	Aug. 6	99 62
" 13	99 62	48 81	" 13	99.62

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56 76	75.14	88 72	July	63 06	78 92	99.62
Feb.	56 74	77.54	85.79	Aug.	68 07	85 40	....
Mch.	57 89	74.13	88 11	Sept.	68.51	100 73	....
Apr.	64.37	72 51	95.35	Oct.	67 86	87.38	....
May	74.27	74 61	99 50	Nov.	71 60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

The tone of silver in London continues good, but no change has taken place in the price. The Shanghai exchange hardened to 4s. 9d. ($1 14), and it is reported that purchases on account of China have been made in the United States. Indian exports of silver during the financial year 1916-17, according to an official report, showed a substantial increase on private as well as on Government account, mainly owing to larger exports of rupees to Mesopotamia, East Africa, the Bahrein islands, and Ceylon, and of piastres, coined at the Bombay mint, to Egypt. The stock at Shanghai on July 6 consisted of 27,100,000 oz. in sycee and 15,200,000 dollars, compared with about 27,450,000 oz. and 14,700,000 dollars on June 29. The cult of notes of low denominations continues to spread. It is reported from Egypt that the shortage of silver coin in that country, notwithstanding that the circulation has been increased by nearly 200% —namely from £2,500,000 to £7,000,000 nominal value—is impelling an issue of 10-piastre notes. The lowest denomination hitherto has been notes of 25 piastres.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date			Average week ending	
July	31	8.37	June 25	8.18
Aug.	1	8.37	July 2	8.78
"	2	8.37	" 9	8.78
"	3	8.37	" 16	8.78
"	4 Sunday		" 23	8.78
"	5	8.37	" 30	8.45
"	6	8.37	Aug. 6	8.37

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.08	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	....
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

Zinc-ore prices at Joplin, Missouri, are still falling. A month ago second-grade was selling at $51 per ton, but now from $42.50 to $47.40, a large quantity last week realizing $45.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds:

Date		Date	
July	16 120 00	July	30 120.00
"	23 120.00	Aug.	6 120.00
		"	13 120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128 06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	....
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115 00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85 13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85 00	Aug.	38.88	62.53	....
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct	41 10	62.24	....
May	49.10	63.21	100 01	Nov.	44 12	74.18	....
June	42.07	61.93	91 00	Dec	42.55	85.00	....

Tin-plate in New York is quoted at $7.75 per box of 100 pounds.

Eastern Metal Market

New York, August 7.

A summer quietness pervades all the markets, little interest being shown. The high temperatures of the past few days have interfered with business also.

Copper is marking time awaiting the outcome of the price meeting at Washington today.

Tin is unchanged, and the metal is still scarce.

Lead continues scarce also.

Zinc is still dull, but a little more interest is being shown.

Antimony is inactive and unchanged.

The problem in the steel industry continues to be the production of enough metal to meet the enormous demand for ships and shells. Every effort is being made to meet this demand even at the expense of many other important industries. The problem is a serious one, and will tax the ingenuity of all concerned. Steel mills are now operating at as near full capacity as possible. The War Industries Board is not inclined to favor the selling of pig-iron for 1919, though several large producers have been doing this already, and on a large scale.

COPPER

While demand continues on a large scale, producers have not been inclined to commit themselves far ahead. The whole situation is dominated by the outcome of the meeting at Washington today between the Price-Fixing Committee of the War Industries Board and the producers' representatives. It has all along been argued that an advance of 1½c. per pound on the present 26c. price, established July 2, is decidedly necessary to meet increased costs arising from new freight-rates, labor demand, and many other factors. A price of 27½c. is confidently expected by many as a result of this meeting, while there are some who predict that 26c. will continue. There is still talk of 30c. by January 1, 1919. There is a dispute between consumers and producers: the former maintain that shipments of metal should be made at the contract price, while some or all of the latter claim that all contracts should be adjusted to the present price or the price ruling. The price to be settled upon at today's meeting is the one that is to be effective after August 15, whether it is the same price or a new one. Some expect it to run to January 1, others look for another adjustment between August 15 and the end of the year. Jobbing lots, 5 tons and less are netting at 27.35c. per lb. [Since this was written the price has been re-fixed at 26c. per lb., until November 1.—Editor.]

As indicating how copper exports have fallen off, it may be pointed out that the total for the 11 months ended May 31, 1918, was 769,002,293 lb. of refined metal in ingots, bars, and other forms, against 848,424,583 lb. in the same period of a year ago.

TIN

Trading continues almost at a standstill, and the entire situation is but little changed from that outlined a week ago. Restrictions of all kinds on imports and in shipping are part causes, as well as the new regulations in the Far East, the full effect of which is not yet known. It is a fact that to sell a lot of tin, six different permits are necessary, three in this country and three foreign ones. As a result, the lot of the importer is not an easy one; and these are not all his troubles. In general the market is lifeless. There have been occasional lots of 25 tons offered by the British, and a few sales were made last week for September shipment from the Straits at 84 and 86c. The spot market continues nominal at 94c., New York. For small lots higher prices have been heard of, but they are not significant of the larger market. Arrivals of tin on the Pacific Coast continue to be large. For July there was 6429 tons, one of the largest months on record. Arrivals at Atlantic ports were 740 tons, bringing the total for July to 7169 tons. The quantity in stock and landing on July 31 was 265 tons. The London market has reached its highest figures, spot Straits having been quoted there yesterday at £394 10s., against £385 a week ago.

LEAD

The situation is unchanged, with the scarcity still pronounced. Prices are fixed virtually by agreement of producers at 7.75c. per lb., St. Louis, and 8.05c., New York, but it is almost impossible to obtain any for early delivery. Much higher prices than these have been obtained by dealers and speculators having a few carloads. The jobbing price in small lots is 9c. per lb. for spot delivery. The Government demands for this metal are and have been large, mostly responsible for the scarcity.

Exports have been immense. For the 11 months ended May 31, 1918, the outgo of lead in pigs, bars, etc., has been 196,533,037 lb., compared with 173,226,307 lb. for the same period of 1917, and with 191,230,081 lb. for 1916. Of the 1918 period the United Kingdom took 113,494,170 pounds.

ZINC

There has been little change in this market, which has continued more or less in action at nominal prices of 8 to 8.12½c., St. Louis, or 8.25 to 8.37½c., New York, for prime Western for early delivery. These are bid and asked prices. The tendency in the past few days has been toward firmness because of a slightly larger interest in the market. The quotation by jobbers for small lots in stock is 9.50c. per lb., New York. Grade A zinc has a maximum Government price of 12c. per lb., but has sold under this.

Sheet-zinc is fixed at a maximum price of 15c. per lb., with plate-zinc at 14c. per pound.

ANTIMONY

For this metal, duty paid, 13 to 13.25c., New York, is the quotation with demand light and the market quiet.

ALUMINUM

For No. 1 virgin metal, 98 to 99% pure, and for scrap, Government prices govern this market. For 50-ton and larger lots, 33c. per lb. is the price, while for 15 to 50-ton lots, 33.10c., and for 1 to 15-ton lots, 33.20c. per pound.

ORES

Antimony: There are no developments in the market here.

Ferro-manganese: Imports for June were 5739 tons, the largest of any month this year. The fiscal year's total this year was 33,259 tons, as compared with 73,741 tons for the previous period.

Manganese: Imports of high-grade ore in June were 38,427 tons against 62,778 tons in June 1917. The total for the fiscal year ended June 30, 1918, was 558,018 tons against 656,088 tons for the fiscal year of 1917.

Molybdenite: The market is quiet at unchanged nominal quotations of $1 per pound.

Tungsten: Prices ruling this market are unchanged at $20 to $24 and $24.50 per unit, the higher prices commanded by the purer ores. Demand is good and fairly active market is reported. Ferro-tungsten is unchanged at $2.40 per lb. of contained tungsten, which could perhaps be shaded.

Book Reviews

Concrete Engineers' Handbook. By George A. Hool and Nathan C. Johnson. 867 pp. Ill, index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press,' San Francisco. Price, $5.

This is probably the most complete and up-to-date treatise on concrete and reinforced concrete that has appeared, covering both theoretical design and construction practice. While some use is made of the material in Hool's 'Reinforced Concrete Construction,' the scope of the present volume is broader. The first chapter discusses materials for both plain and reinforced concrete. The next two chapters are devoted to methods of construction and to construction plant. Then comes a chapter, which might appear to be out of its logical order, on floors, sidewalks, and pavements. Properties of mortar, plain concrete, and reinforced concrete are then considered. The authors then lead up to the design of buildings through the divisions of beams and slabs, columns, bending and direct stress, and moments in building-frames. Foundations and retaining-walls are then discussed, and then slab and girder bridges, and floors and abutments for steel bridges. The chapter on arches considers also arch bridges. The chapters on hydraulic structures includes under this title, dams, reservoirs, stand-pipes, tanks, and culverts. The two final chapters are devoted to miscellaneous structures and to estimating. Appendixes contain standard specifications for cement, building regulations, and similar data, also a brief discussion of concrete-ship construction. The book is well illustrated and there is a good index.

Elements of Fuel Oil and Steam Engineering: A Practical Treatise Dealing with Fuel Oil for the Central-Station Man, the Power-Plant Operator, the Mechanical Engineer, and the Student. By Robert Sibley and Charles H. Delany. Pp. 320. Index, illustrated. Technical Publishing Co., San Francisco, 1918. For sale by the 'Mining and Scientific Press.' Price, $3.

The treatment of the subject justifies the title of the book. It gives an account of every practical detail of the equipment with which the fuel engineer will have to deal in his daily work. It does not assume familiarity with this equipment, and lead the student into a consideration of the higher principles, and in this respect it will be of extreme value to the student and to the operator who will find it a guide to the things that are assumed as already known by the writers of more advanced text-books. The senior author is now the editor of the 'Journal of Electricty,' and the junior author is a steam-power plant specialist in active practice in the handling of large and complicated operations. The sub-headings treated include the fundamental laws involved in fuel-oil practice, theory of pressures, measurement of temperatures, elementary laws of thermodynamics, steam-tables in fuel-oil practice, computing boiler horse-power, equivalent evaporation and factor of evaporation, the steam calorimeter and its use in fuel-oil practice, rational and empirical formulas for steam constants, the boiler shell and its accessories for steam generation, boiler classification in fuel-oil practice, specifications for purchase of fuel-oil, heating value of oils, taking of boiler-test data, heat-balance and boiler-efficiency, and so on. It is eminently practical.

Quaternary Geology of Southeastern Wisconsin. By W. C. Alden. Professional Paper 106 of U. S. Geological Survey, Washington, 1918. Pp. 356, ill., index.

While this report contains little connected with mining, yet it will be found of interest. The mineral resources are limestone and building materials, iron ore, and peat.

Recent Publications

The following are arranged under the subjects to which they refer:

Coal

Use of Permissible Explosives in the Coal Mines of Illinois. By J. R. Fleming and J. W. Koster. Bulletin 137 of the U. S. Bureau of Mines, Washington, 1917. Pp. 110. Ill., index.

Quick Determination of Incombustible Matter in Coal and Rock-Dust Mixtures in Mines. By A. C. Fieldner, W. A. Selvig, and F. D. Osgood. Technical Paper 144 of U. S. Bureau of Mines, Washington, 1918. Pp. 33. Illustrated.

Effects of Moisture on the Spontaneous Heating of Stored Coal. By S. H. Katz and H. C. Porter. Technical Paper 172 of U. S. Bureau of Mines, Washington, 1917. Pp. 23. Illustrated.

Weights of Various Coals. By S. B. Flagg. Technical Paper 184 of U. S. Bureau of Mines, Washington, 1918. Pp. 11.

Storage of Bituminous Coal. By H. H. Stock. Circular No. 6 of Engineering Experiment Station, University of Illinois, Urbana, 1918. Pp. 187. Illustrated.

Analyses of Canadian Fuels. Part IV, Alberta and Northwest Territories. Compiled by Edgar Stansfield and J. H. H. Nicolls. Bulletin 25 of Dept. of Mines at Ottawa. Pp. 68.

Analyses of Mine and Car Samples of Coal Collected in the Fiscal Years 1913 to 1916. By A. C. Fieldner, H. I. Smith, J. W. Paul, and Samuel Sanford. Bulletin 123 of U. S. Bureau of Mines, Washington, 1918. Pp. 478, ill., index.

Explosives

Initial Priming Substances for High Explosives. By G. B. Taylor and W. C. Cope. Technical Paper 162 of U. S. Bureau of Mines, Washington, 1917. Pp. 24.

Use of the Interferometer in Gas Analysis. By F. M. Seibert and W. C. Harpster. Technical Paper 185 of U. S. Bureau of Mines, Washington, 1918.

Mining

Quarry Accidents in the United States in 1916. Compiled by A. H. Fay. Technical Paper 193 of U. S. Bureau of Mines, Washington, 1918. Pp. 57.

Metal-Mine Accidents in the United States in 1916. Compiled by A. H. Fay. Technical Paper 202 of U. S. Bureau of Mines, Washington, 1918. Pp. 91. Index.

Silicious Dust in Relation to Pulmonary Disease Among Miners in the Joplin District, Missouri. By Edwin Higgins, A. J. Lanza, F. B. Laney, and G. S. Rice. Bulletin 132 of U. S. Bureau of Mines, Washington, 1917. Pp. 116. Ill., index.

Mineral Resources of Alaska, 1916. By A. H. Brooks and others. Bulletin 662 of U. S. Geological Survey, Washington, 1918. Pp. 469, ill., maps, index.

Oil

Bibliography of Petroleum and Allied Substances, 1915. By E. H. Burroughs. Bulletin 149 of U. S. Bureau of Mines, Washington, 1918. Pp. 147. Index.

Recovery of Gasoline from Natural Gas by Compression and Refrigeration. By W. P. Dykema. Bulletin 151, Petroleum Technology 40 of U. S. Bureau of Mines, Washington, 1918. Pp. 123. Ill., index.

Relative Resistance of Various Hardwoods to Injection with Creosote. By C. H. Teesdale. Bulletin 606 of U. S. Department of Agriculture, Washington, 1918. Pp. 36. Illustrated.

Geology

Geology of the Tuapeka District. By P. Marshall. Bulletin 19 of Geological Survey of the Department of Mines of New Zealand, Wellington, 1918. Pp. 79. Ill., index. Some interesting notes on tungsten are to be found in this work.

INFORMATION FURNISHED BY MANUFACTURERS

COMMERCIAL PARAGRAPHS

The Stag Mining Co., Galena, Kansas, is having plans prepared for the erection of a new 200-ton mill. J. L. Hart, Salem, Kansas, is the engineer.

The Rockwood Silicate Works, South Rockwood, Michigan, recently destroyed by fire with loss estimated at $20,000, is planning for the re-building of the plant.

The General Aluminum & Brass Casting Co., St. Aubin street, Detroit, Michigan, has filed plans for the construction of a new one-story, reinforced concrete addition to cost $25,000.

The Union Smelting & Refining Co., Avenue L and St. Charles street, Newark, New Jersey, has taken out a building permit to make improvements in its works to cost about $18,000.

Preliminary plans are being prepared by the **Monsanto Chemical Co.**, St. Louis, Missouri, for the construction of new works in the vicinity of East St. Louis, Illinois, to cost about $750,000.

The Michigan Copper & Brass Co., West Jefferson avenue, Chicago, has commenced the erection of a new one-story building to be used as a rod mill. Westinghouse, Church, Kerr & Co., 37 Wall street, New York, are the engineers.

The Mueller Metals Co., Decatur, Illinois, will build two new mill additions to its works, consisting of a one-story structure, about 85 by 140 ft., and one-story tube-mill, 80 by 280 ft. Plans for the extensions have been completed.

The International Steel Tube & Rolling Mills, Inc., Cleveland, Ohio, is planning for the construction of an addition to its mills at Warren, Ohio, to be used as a steel-tube works and rolling mill. The extension is estimated to cost $500,000.

The Semet Solvay Co., Syracuse, New York, is having plans prepared for a new picric acid works to be erected at Chicago. The proposed plant is estimated to cost about $2,000,000, and will be used for the production of material for the Government.

The Southern Minerals Corporation, Elizabethton, Tennessee, is perfecting plans for the development of property containing bauxite and iron-ore mines, and will be operated in different sections as equipment is put in place. B. D. Harmon is treasurer of the company.

The Gulf Refining Co., Widener building, Philadelphia, has completed plans for the construction of a new refining works at Pittsburgh to cost about $200,000. The plant will be constructed in 10 brick and steel units, to be operated, it is understood, as fast as erected and equipped.

The Arizona Oil Co., Ridgewood, New Jersey, has been incorporated under New Jersey laws with capital of $2,500,000 to operate oil properties in Arizona. Harry W. Forher, Ridgewood; Louis O. Condit, Boonton, New Jersey; and Frederick W. Jackson, New York, are the incorporators.

The Walworth Log, published by the Walworth Manufacturing Co., of Boston, Massachusetts, is an attractive periodical, dealing with the practical applications of the pipe and fittings made by this company. The illustrated article in this issue, No. 6, of volume 5, on ship construction is peculiarly interesting.

The California Molybdenum Co., Inc., New York, has filed articles of incorporation, with a capital of $50,000, to operate mining properties in California. A. M. Barnes Jr., 55 East 76th street, New York, and C. T. Alt, 311 Baltic street, Brooklyn, are the principal incorporators.

The proposed new rod mill of the **Michigan Copper & Brass Co.** will be erected as an extension to the present works of the company at Detroit, Michigan. The final plans call for a structure to cost about $150,000. Westinghouse, Church, Kerr Co., 37 Wall street, New York, is in charge of construction.

The Air Nitrates Corporation, 360 Madison avenue, New York, has completed arrangements with the Government for the construction and operation of a new plant at Elizabethtown, Ohio, to cost about $20,000,000. A site of about 500 acres will be used for the proposed works. The project, it is understood, will be financed by the War Department.

The new coke works of the **Donner Steel Co.**, Buffalo, New York, to be erected for Government service, will cost over $5,000,000. The company has acquired a site of 40 acres on the Buffalo river for the new plant. A department will be provided for the production of toluol for high explosives. The financing of the project will be handled by the Government.

The Acme Motor Truck Co., of Cadillac, Michigan, has found it necessary to increase the size of its plant. This summer a wood-working and body-shop 65 by 80 ft., an addition to the assembly building 65 by 96 ft., a heating and power plant 46 by 80 ft., an office 80 by 118 ft., two washrooms 12 by 30 ft., and a dining room 13 by 46 ft. The boiler room is 46 by 48 ft. with 20 ft. head-room, large enough to accommodate four large horizontal-tube boilers.

About $500,000 will be expended for machinery for the new chemical manufacturing works of the **Bon Air Coal & Iron Corporation**, Nashville, Tennessee, to be located at Lyles, Tennessee. The plant will have an initial capacity of about 40,000 lb. of acetate of lime daily, and approximately 2000 gal. of crude alcohol. The entire works will be used for Government service and is estimated to cost complete about $1,000,000. The George A. Fuller Co., 175 Fifth avenue, New York, is contractor for the buildings.

The Cottrell dry concentrator that was put on the market recently by the **Cottrell Engineering Co.** of Los Angeles, California, will shortly be used at a silver-lead property near Tucson, Arizona. The machine operates on the principle of air flotation, supplementing a high-speed jigging motion. It is simple in construction, economical in operation, and yields a high recovery of the mineral. The company is also manufacturing machines for its own operations at silver-lead, copper, and tungsten properties.

The Steel City Electric Co., of Pittsburgh, makers of electrical specialties, has just published catalogue No. 33,

a handsomely printed and illustrated book of 108 pages, describing and figuring a multitude of articles, including adapters, attachment plugs, automobile junction boxes, all types of boxes, bushings, outlets, clamps, telephone ells and tees, fish-wire, shock absorbers, and others. The company has ceased the publication of bulletins, and issues a complete catalogue instead, of which this supersedes bulletins No. 21 to 30, and No. 32.

The Bastian-Blessing Co., of Chicago, has issued a catalogue dealing with the Rego oxygen-acetylene, and oxygen-hydrogen welding and cutting apparatus. The catalogue is illustrated, and shows complete outfits, with description of the several pieces in each group. A feature of the torches to which special attention is directed is the arrangement for preventing the annoying 'flash-back', or back-firing while cutting. This difficulty is wholly eliminated, and will not occur whether the piece cut is a half inch or six inches, whether dirt or sand is on the metal or not, or even in confined spaces where the head is subjected to considerable heat. The engineer in charge of apparatus for the Bastian-Blessing Co. is Keith Dunham.

Dixon's waterproof graphite grease is composed of high-grade mineral stock to which has been added the proper amount of Dixon's selected flake graphite. The graphite is the vital element, for it imparts to wearing surfaces a remarkable smoothness that relieves the grease of a considerable portion of its task of keeping rough surfaces apart. The flake graphite increases both the efficiency and endurance of the mixture, thus enabling the grease to do heavier duty than would otherwise be possible. Waterproof grease will not stick to wet surfaces. It is, therefore, important that surfaces be dry when the first application is made. On account of its dense sticky nature, waterproof grease should not be used in grease cups. Lubricants of this nature are described in Booklet No. 140-W published by the Joseph Dixon Crucible Company.

Jasper Stone Co. has long been manufacturing grinding-pebbles and tube-mill linings, sold in the market under the trade name 'Adamant Silica.' The term is accurately descriptive. The art of making a substitute for Baltic pebbles has developed under the direction of the Jasper Stone Co. so that a material of equal hardness and resistance, both to blows and to decomposition by chemicals, is regularly produced. In imitating the natural pebbles it follows, as a consequence of making a careful mixture of the ingredients, that perfect homogeneity is attained. This is something that does not exist in the Baltic pebbles, which have been formed by replacement, so that lines of differing composition in the original are reproduced with different texture in the quartz pebble, leading to lack of uniformity in wear. A perfectly homogeneous artificial pebble wears with evenness, and consequently does more effective work up to the last, as shown by more than two years of constant service. These 'Adamant Silica' pebbles are now used for grinding ores, cement, and other substances in 22 States, and in Alaska. Within the past six months the Chino Copper Co. alone has taken 20 carloads of pebbles to be used in grinding its copper ore for concentration. The Utah Copper, the Ray Consolidated, and other of the greatest mining companies are now using the Jasper Stone Co.'s pebbles. The further use of steel balls will be impossible, on account of the Government requisitions for the total iron and steel output in war-uses, and at the same time the shortage of ships and other impediments have made it out of the question to import natural pebbles. The artificial pebble is ready to take the place; having already been proved to be an ideal material for this purpose. The same substance is of the greatest utility as a lining for tube-mills, flotation cells, and other equipment where abrasion occurs; it is also resistant to acids and is adaptable to tanks, vats, launders, and other parts of chemical and metallurgical works where corrosive solutions are employed.

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Mining and Scientific Press

Edited by T. A. RICKARD

Volume 117
Number 8

SAN FRANCISCO, AUGUST 24, 1918

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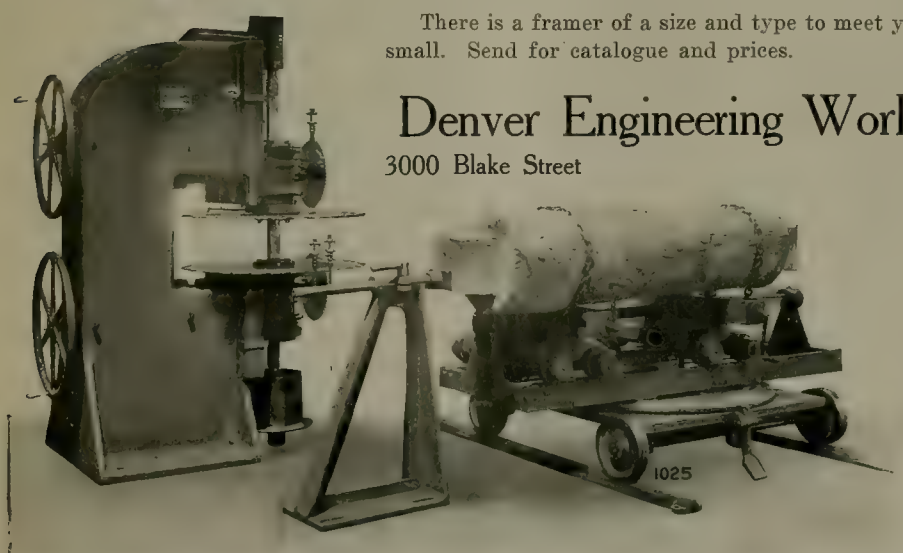

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EDITORIAL STAFF

T. A. RICKARD, Editor
COURTENAY DE KALB, Associate Editor
M. W. von BERNEWITZ, Assistant Editor

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BUSINESS STAFF:

C. T. HUTCHINSON, Manager
E. H. LESLIE, 600 Fisher Bldg., Chicago
A. S. BREAKEY, 3514 Woolworth Bldg., New York

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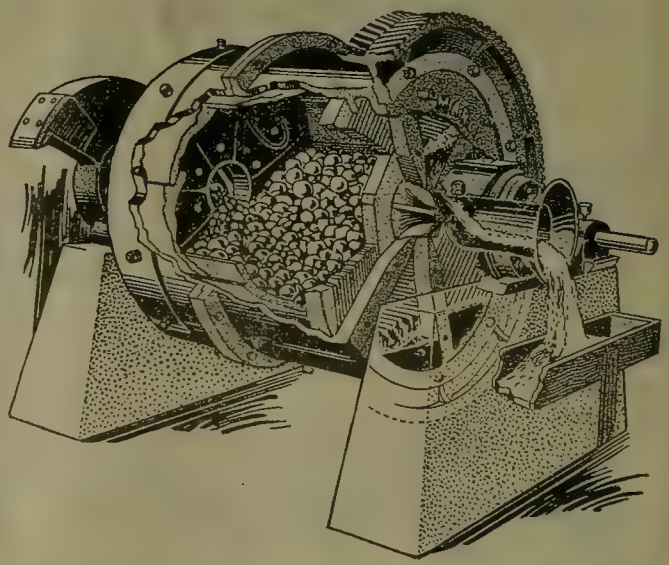

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WE are glad to be able to state that the U. S. Bureau of Mines has appointed Messrs. H. Foster Bain, Charles W. Merrill, and J. Edward Spurr a committee to prepare a plan for organizing an industrial mining reserve in connection with the new draft law. This means an intelligent effort on the part of the Government toward the compulsory exemption from military service of such men as are necessary for the maintenance of metal production.

ON the whole we prefer the dentist to the ambassador as a retailer of gossip concerning the court of the All-Highest. Dr. Davis is more interesting than Judge Gerard, particularly when he gives us the Kaiser's opinion of Hearst and his hired scribes. W. R. Hearst should be proud of the Over-Lord's statement, according to the dentist, that "Mr. Hearst has helped our cause very much in your country." Again the same commentator on great events is reported, by his dentist, to have said: "Mr. Hearst is the only one, so far as I could find, who has revealed the real conditions and told the truth about them." This is "a gift" from the Kaiser to the champion exponent of yellow journalism.

RUMOR states that Mr. Bernard M. Baruch is reaching out for the War Minerals administration in case it is organized under the bill now before Congress. This would take it from the Department of the Interior, with which Secretary Lane is identified. We hope that nothing of the kind will happen, for if a War Minerals administration is established we would be sorry to see it pass under the hands of a speculative financier like Mr. Baruch. The steel and copper people are trying to kill the War Minerals bill and if the attempt to legislate ends in a mere Federal corporation, to buy secondary minerals, they will have succeeded. The mining industry calls for something more than that, some means to ensure the eventual amortization of the capital going into the production of war minerals.

ANNOUNCEMENT is made that the corporate name of the Selby Smelting & Lead Co. has been discontinued, the plant to be known hereafter as the Selby Smelting Works, but the business will be conducted under the same management as heretofore in the name of the American Smelters Securities Co., which corporation Chester A. Thomas, formerly manager for the Yukon Gold Co. at Dawson, as manager. Mr. H. B. Underhill, Jr., as financial agent, perpetuates an association that dates from 1876. The Selby smelter is an important industrial asset to San Francisco.

RETAIL prices of food in the United States have increased 66% since June 1913, according to the Department of Labor. This will induce further homage to that tyrannical factor now initialed as H. C. L.; but the cost of living is neither the retail price of food nor the average of many staples as given in the index number of the statistician, such as 'The Statist' or 'The Annalist'. The expenses of living in a civilized country include many items ignored by the authorities mentioned, such as rent, water, gas, light, clothing, domestic service, and other things necessary to an average scheme of existence. We still believe that 40% is a fair approximation to the increase in the expense of the ordinary citizen since the Germans mistook Belgium for a road to Paris.

LAST WEEK the engineers of San Francisco had a pleasant opportunity of meeting and hearing Mr. James F. Callbreath, the permanent Secretary of the American Mining Congress. He had come from the Gold Conference at Reno, so he was invited to give an address before the Engineers' Club on the status of gold, the taxation of mines, and the War Minerals Bill. Among other things he stated that the Bill had provoked such opposition before the Senate Committee on Mines as to cause Senator Henderson to draft a new bill creating a War Minerals Corporation, with a capital of $50,000,000, to be used for buying and stimulating the production of the secondary minerals, and that it was hoped the House would pass this new bill, although the lower legislative chamber might take umbrage at the radical change made in the Bill as originally drafted. Mr. Callbreath was asked to say something concerning the organizing of a local chapter of the American Mining Congress, a matter that has been taken in hand by the California Metal Producers Association and other representative groups. He outlined the work he and his associates were doing and asserted that he was not ashamed to say that the Mining Congress was "devoted to mining politics," for an interest in politics was part of the duty of every intelligent citizen. The representatives of the Mining Con-

tion has assumed all assets and liabilities. We are glad that a famous old name has been retained, notwithstanding the change of status. Mr. Eugene B. Braden continues to be general manager of the smelter, with Mr. gress endeavored to keep watch at Washington so as to save the mining industry from ill-advised legislation. The miner, and those dependent upon him industrially, need such protection at headquarters, for there was a vast amount of ignorance to overcome among the lawmakers. A resolution was passed supporting the American Mining Congress and appointing a committee, headed by Mr. Albert Burch, to take steps for the formation of a State chapter. We take pleasure in recording this fact and hope that it will have the effect of bringing the mining men of California to the organized support of the American Mining Congress.

EXTENSION of the draft downward to those 18 years old and upward to those 45 years old has the immediate result of placing the entire effective manhood of the country under military requisition. It does not mean that all men between 18 and 45 years of age must serve in the Army or Navy, but it does enable the Government to ensure that all either 'work or fight'. One consequence is that the unemployed, whether rich or poor, are compelled to do something that is useful for the great purpose in hand. Mr. Gompers and other leaders of the labor-unions appreciate, of course, that this enactment places an embargo on strikes, compelling any recalcitrant workers to submit their grievances to arbitration under penalty of being drafted as soon as they indicate the intention to abstain from productive work. If the law is applied fairly, as we feel confident it will be, so as to compel the unemployed of every class, including the flaneurs and sportsmen of the richer element in the community, to 'work or fight', we see nothing but good in the result. The sooner the whole country is mobilized to defeat the Prussian purpose and restore international law, the better for all, rich and poor alike.

GENERAL MARCH, Chief of Staff, spoke with remarkable frankness to the Senate Committee on Military Affairs. It is a sign of the times that such forthright speaking is appreciated not only at Washington but throughout the United States. "The policy of the War Department," he said "is to put the maximum number of men in France with the idea of shortening the War." We have 1,500,000 there now; we are to have 80 divisions of 40,000 each, or 3,200,000 men, in France by June 30 of next year. The military energies of this country are "to be centered on the Western front from this time on," so as to break the Enemy decisively where he will feel it most. "The only way that Germany can be whipped is by America going into this thing with her whole strength." The country is fully prepared to back up this policy with all its resources in men and material. The General added: "We are going to win this War if it takes every man in the United States." It is well that our Allies and the Neutrals also should understand that nothing less than this is our firm intention; the Enemy is learning to appreciate the fact already; he is being as much disheartened by the intensity with which the American is going into the fight as our Allies are being cheered by the vigorous aid we are giving them. We are in it to a finish; the world is beginning to understand that we intend that the War shall not drag its tale of horror and misery across many more years.

ON another page we publish an account of the Gold Conference at Reno by Mr. De Kalb, who took a useful part in the proceedings. From letters received we are aware that the gold-mining fraternity is alive to the compelling seriousness of the crisis and is glad to see so much publicity given to the subject. In London the financial community has awakened to the fact that not only is gold mining threatened but that the industrial security of the Allies is menaced by the decreasing production of gold. Recent monthly statistics show that in West Africa, Rhodesia, and Australia, as in the United States, the output of the standard metal is declining alarmingly. As our friend Mr. F. H. Hamilton says, in a letter to the 'Financial Times,' "after the War Germany must purchase her raw material either for manufactures or for gold. The former she will not possess, and if she depletes her stock of the latter, presuming the gold standard to be maintained in other industrial countries, the basis upon which her currency rests will be so weakened as to depress her credit and hamper her international commercial activities for a long time to come." In short, the fact that the Allies control 92 to 95% of the gold production of the world is an economic weapon of the greatest value; to an unusual degree gold has become the sinews of war; not only is it the basis of a towering structure of credit but it is destined to be the controller of international trade with the Enemy when he has been brought to account. Is the production of gold a source of strength to the cause of the Allies? If it is, shall we allow it to be stricken for lack of proper measures of support?

HOW securities have met the shock of the world war is shown by a tabulation of representative stocks appearing in 'The Annalist,' comparing the closing prices on the eve of war, July 30, 1914, with the prices quoted on July 31, 1918. We give a few of the figures.

Companies	July 30, 1914	July 31, 1918
20 railroads	87.43	78.53
10 public utilities	92.31	72.37
7 steel, iron, and coal	27.91	78.92
10 copper, lead, and smelting	31.06	48.37
5 metal manufacturing	54.20	66.97
4 oil	56.28	84.81
7 food and food products	52.80	72.23

It will be seen how the metal-producing and manufacturing companies have prospered, but the figures do not cover the high prices of the boom period two years ago when the top quotations for the group third on the above list averaged 182.12, the fourth 76.83, and the fifth 101.42, while the first and second reached a high mark of 111.07 and 117.51 respectively. After the declaration

of war by the United States there was a period of liquidation lasting to nearly the end of December 1917, but since then the market has been surprisingly strong, even in the face of the bad news that came to hand during the German offensives in March and April. As yet the complementary effect of the good news of the Allied counter-offensives has not made itself felt on the Stock Exchange, which, it must be conceded, has shown a fine spirit of sane optimism throughout the War.

THE latest Institute bulletin contains a great deal of interesting matter, the compilation of which suggests the work of a competent editor. It is a pity, however, to give the remarks verbatim of everybody that rises to speak at a dinner; for instance, in the account of the dinner at Washington, an interesting and thoughtful speech by Mr. Hoover and an elaborate statement by Mr. Pope Yeatman are mixed with sundry observations by others whose engaging presence is required to save them from seeming ridiculous. The Women's Auxiliary, which is endeavoring to Americanize the mining industry, makes a report of its work through Mrs. C. C. Burger, the chairman of a special committee organized for this purpose. The work being done by the wives of members in furthering Americanization should receive enthusiastic support, for it is of the greatest value to the Nation. A list of those 'Died in Service' has been started; as yet it includes only 11 names, but it is destined, we fear, to fill several pages before the end of the War. 'News from Members at the Front' is an interesting departure and should grow in scope as our representatives in Europe realize how eager we all are to hear from them. The list of 'Members of the Institute in Military Service' suffers by the inclusion of non-military gentlemen, such as one who is "stimulating the production of chrome ore" in California, members of the Food Administration, and others engaged in purely civil work. Discrimination is needed in preparing these lists of honor, otherwise they lose their value. Ten pages are given to 'War Activities of the Engineers'; this furnishes much timely and necessary information for those willing and able to take part in various branches of useful activity, including research, submarine, and military service. Sir Robert Hadfield, the famous metallurgist and steel manufacturer, contributes a delightful note on 'British and American Friendship', in the course of which he dwells upon the welding of the English-speaking peoples as a direct consequence of the War. To this he adds a comprehensive statement describing the various steps being taken at present in Germany to develop and encourage scientific research and to prepare for the rehabilitation of trade after the War; he also gives a translation of a recent account of the present conditions of mining and metallurgical industries in Germany. All of which is valuable information. Finally, this compilation of interesting information concludes, most appropriately, with an appeal to members of the Institute as intelligent men to attend to their civic duty at the polls in the forthcoming Congressional elections.

The American Gold Conference

When Governor Emmet D. Boyle called a conference of gold miners to meet at Reno it is fair to say that the usefulness of the meeting was doubted. This skepticism was expressed in the East more than in the West. The outcome, however, has been a presentation of the hardships of the gold-producer, coupled with an appreciation of the needs of the financial world, that will command the respectful attention of the country. It is merely to state a historic fact that the East instinctively distrusts the West whenever it deals with the fundamentals of national finance. It was in Kansas that the greenback heresy was longest advocated; the division on the question of bi-metallism was almost along sectional lines, so preponderant was the Western demand for free silver. The case of the gold miner, struggling today against costs, which, like the enveloping mistletoe, are eating out the heart of the oak from which alone the structure of national credit can safely be built, was prejudiced in advance by arguments for raising the 'price' of gold. Adverse criticism of the meeting developed promptly, but the representatives of the gold-mining industry who assembled at Reno have done a notable thing: they have declared in unequivocal terms for sound money. They petition the Government for relief; they leave it to the discretion of the authorities at Washington to determine the kind and measure of that relief; but they declare in their resolutions, which voice the opinion of the Conference, that "nothing contained in these resolutions is to be construed as meaning an intention to alter the amount of gold in the dollar, nor to place a premium upon gold." It must bring satisfaction to the bankers and financiers, who are struggling to carry our credit ship on an even keel through the troubled waters, to receive such a pledge of allegiance to the principles of sound money from a convention of gold miners assembled in Nevada. This should win the instant support of the East to the request of the gold-producers for assistance. It now becomes evident that the Eastern banker and the Western gold miner can make common cause, for the banker is as deeply interested in maintaining an unbroken stream of gold from the mines of the West to the Treasury at Washington as are the owners of the mines themselves. Incidentally, who are the owners of the gold mines? Through the distribution of stock they are mainly capitalists in the East. The producers then consist of these, of the staffs in charge of operations, and of the laborers who perform the work of mining the ore and extracting the bullion. Gold mining, as an operation, is Western, but as an enterprise it is national. In view of its fundamental position in providing the basis of exchange, without which we must presently witness a wasting gold-reserve while the stream of fresh supply is cut off, it would seem logical that the American Bankers Association, at its session in Chicago next month, should endorse the petition of the American Gold Conference for relief, and co-operate in securing prompt action to accomplish it. The stress has become so great, from the increased

cost of supplies and labor, and the diminishing ranks of the miners who are attracted by the higher wages offered at shipyards and in other favored industries, that governmental action may not long be deferred if the more important gold properties are to be saved from closure.

The conference at Reno has developed into a national organization, with active committee-men in twelve States. The personnel of the executive committee, given on another page of this issue, will inspire confidence both East and West; it consists of men with a national reputation for executive as well as technical ability. The Conference has not tied their hands by insistence upon details of policy; it has, however, closed the door against any change in our monetary standard, which strengthens the position of the committee with the sound business men of the country, whom they must win to their side. It would appear that the remedy for the depression in the gold industry will be sought in preferential treatment, if that be found sufficient, and, if not, in the payment by the Government of a direct royalty on the new gold produced. The recognition of the service performed in strengthening our gold reserve through the payment of a royalty would appear to be the simplest means, and this is likely to be seriously considered. If the amount be sufficient to sustain the mines that are operating nearest to the economic limit, those needing less assistance would part with the excess automatically under the forthcoming tax-law, which thus would serve the function of an equalizer. In some manner relief must be given without delay if the production of gold in the United States is to be saved from inevitable collapse. We publish more letters on the subject and expect our readers to help us in awakening the public to the seriousness of the crisis.

A Protest

Technical Societies, besides performing their normal function as purveyors of information useful to the profession, are engaging in commercial publishing, that is, they solicit advertising for revenue. For instance, the August issue of 'The Journal of the American Society of Mechanical Engineers' differs but little in appearance from any one of a dozen trade papers, even the size of the pages showing a radical departure from the standard adopted by the bulletins of the technical societies. There are two reasons for objecting to the commercialization of professional organizations such as the American Society of Mechanical Engineers and others that we need not mention. One is a matter of taste, concerning which we know it to be proverbially useless to dispute. There is no accounting for taste, or the want of it. The second is expressed by the proverb *ne sutor ultra crepidam*. It seems a pity for engineering societies to trespass upon the domain of the engineering papers; it appears undesirable for the one to try to do what the other is doing so well. If the technical press were inefficient, if it were deteriorating so obviously as to call for a corrective or a substitute, then there would be some reason for the invasion of the journalistic field by the professional organizations. No such reason exists. Technical journalism of the kind that is based upon commercial publishing has improved greatly during the last two decades, so that no excuse, except the making of money, exists for the trespass of the professional societies into a field outside their proper scope. There are other reasons, not so easy to state politely. When an engineering firm or a manufacturing company headed by engineers is asked to advertise in the professional society's periodical—a journal or a bulletin—it is intimated that such advertising should be given in order to support the society, otherwise the firm or company will "get in wrong with" the directors of the society. This is gentle blackmail, of course. A trade paper that tried any such method would soon be made to feel sorry for it; no solicitation for business is tolerated by its clients except the undertaking to give adequate publicity in exchange for the money paid according to contract. One hears warnings against the commercializing of the profession, but does it occur to those who are so eager to commercialize the reputation of a professional society by using its bulletins for advertisements that they are setting the worst possible example? An engineer pays $15 per annum in dues in order to obtain the privilege of being a member of a professional society and of obtaining a mass of poorly edited reading-matter; he can obtain as much as he can read, better prepared, for a third the cost by subscribing to a first-class technical paper, of which there are enough in number and in variety to suit everybody. We recall the attempt made several years ago by the owner of the 'Pacific Miner', in San Francisco, to mobilize his readers into a technical society at the price of the annual subscription, which was modest. In return for the subscription his readers received the valuable information purveyed weekly (and weakly) by the 'Pacific Miner' and with it the right to attach R. S. V. P. or P. D. Q. after their names! This was about as logical as some of the efforts being made by the controllers of sundry professional societies at their headquarters, mostly in New York. It is about time for these associations to determine what purpose they have in view and what work they expect to perform for the profession and for the country. We see no reason why the technical press should submit tamely to an increasing invasion of its territory, within which it is doing honest service for the profession. Encouragement for this protest is to be found in the policy followed by the strongest of the engineering organizations. In these, as in other matters, the American Society of Civil Engineers sets a good example; so does the Institution of Mining and Metallurgy, in London. Both these societies have refused to solicit advertising for the very reasons we have stated. We hope that the members of the engineering profession generally will take an interest in the question and make their influence felt at headquarters. The society that commercializes its activities loses its character, and, we are frank to say, rarely delivers a journalistic product sufficiently good to excuse the departure from honorable precedent. Let the shoemaker stick to his last.

American Gold Conference

By COURTENAY DE KALB

Four notable things were brought out at the meeting of the leading gold-producers of America, who assembled at Reno, Nevada, on August 12, 13, and 14, in response to a call issued by the Governor, Mr. Emmet D. Boyle. These things were a unanimity of opinion that gold mining will almost wholly cease unless Government assistance be extended at an early date; that the gold miners, as the producers of the monetary metal, are opposed to any change in the existing standard on which our currency and credits are based; that the Government has definitely placed gold mining on the list of preferred industries as an essential for war-finance; and that the workingmen appreciate their relation to the industry as partners in the production of gold. The attitude of the delegates to the Conference is expressed in the following resolution:

WHEREAS, gold production in the United States has declined from $101,000,000 in 1915, to $84,000,000 in 1917, with a still greater decrease now taking place, the production of California alone having declined $3,000,000 in the first six months of the present year; and

WHEREAS, this decrease is principally due to the increased cost and shortage of labor and material, the price of gold, as our standard of value, being fixed by law at the invariable figure of $20.6718 per ounce, thus being the only important product which has not obtained an increased market price due to the present war conditions; and

WHEREAS, under present conditions capital cannot be obtained for gold mining, but is generally being withdrawn wherever possible from the said industry; and

WHEREAS, on account of the increased cost of production with no increase at all in the market price of their product, many mines have been forced to cease operations in the last six months, many others are now running at a loss, and are about to be closed down or abandoned, and from their nature will require years to be re-opened, so that a large portion of the gold mining industry is now threatened with extinction; and

WHEREAS, a war emergency exists, which we are advised by our Government necessitates the maintenance, and, if possible, the increase of gold production in the United States, as of next importance after food and war munitions, being of vital importance as a basis for our continually expanding credits, which are necessary both for the financing of the war and for reconstruction after the war; and

WHEREAS, the gold resources of the United States are adequate to maintain our former production, and to afford under proper encouragement a substantially increased production; now therefore be it

RESOLVED, that it is the sense of this meeting that of all the various measures which have been suggested, the following will be the most effective in maintaining and encouraging the production of gold in the United States, namely, relief by the United States to the gold producers of this country to correspond with the increased cost of production, the extent of such relief to be fixed from time to time to meet changing conditions; but nothing contained in these resolutions, as passed, is to be construed as meaning an intention to alter the amount of gold in the dollar, nor to place a premium upon gold.

The emphasis laid upon the maintenance of sound money, as seen in the last paragraph, will meet with the appreciation of bankers and financiers, and will accord with the desires of Secretary McAdoo to foster the production of gold for the purpose of broadening the foundations of national finance.

All doubt as to the exact position of gold in the priority classification was removed by a telegram from Edwin B. Parker, Priorities Commissioner, in answer to a request from the Conference for a statement on that point. His reply was: "The following resolution was adopted by the Priorities Board. Be it resolved by the Priorities Board that gold mining is an essential war industry, and the powers of this Board be so exercised as to accord to such industry preferential treatment in the supply, not only of tools, machinery, and equipment, but in the transportation service, fuel, and labor-supply." This means that, so far as labor is concerned, the employees at gold mines will be in the deferred classes under the draft, and will not be subject to call except in the event of a serious need, which is not likely to arise. The endorsement of the aims of the Gold Conference by Labor was contained in a telegram from Charles H. Moyer of the International Mine, Mill, and Smelters Union, as follows:

I am instructed to inform your convention that the International Union of Mine, Mill, and Smelter Workers are in full accord with the efforts of the gold producers to stimulate the production of gold and to offer the cooperation of our International to that end. It is also the sense of our organization that on account of the rapidly increasing cost of living the question of wages must necessarily be considered jointly with the cost of production, may I suggest that in our opinion the best interests of our nation, the producers, and labor can be conserved through our joint action in this important matter.

It is evident that the movement for aiding the gold miners has been crystallized under conditions that should ensure public favor. With the expectation of being able to co-operate with the mining associations of the several States, and recognizing that the leading gold mines of the country were represented at the meeting, a permanent organization was effected under the national title of the American Gold Conference. For the present the general office of the association will be in the Reno National Bank building, at Reno, Nevada, with Henry M. Rives as secretary. For the purposes of expanding the organization, so as to have direct representation of the several gold-producing States in its active propaganda, a general committee was appointed consisting of Albert Burch,

California, B. L. Thane, Alaska, H. N. Lawrie, Oregon, Bulkeley Wells, Colorado, J. A. Burgess, Arizona, George T. McGee, Montana, Imer Pett, Utah, Robert N. Bell, Idaho, E. H. Clark, South Dakota, J. G. Kirchen, Nevada, and Milner Roberts, Washington.

For the more energetic work of bringing the facts regarding gold mining to the attention of the authorities in Washington an executive committee was constituted as follows: Emmet D. Boyle, Carson, Nevada, W. J. Loring, San Francisco, California, Bulkeley Wells, Denver, Colorado, Whitman Symmes, Virginia City, Nevada, and George W. Starr, Grass Valley, California. Other permanent committees were: Finance, Eugene Davis, G. W. Starr, and G. M. Taylor; Publicity, John G. Barker, Eugene Davis, and Courtenay De Kalb.

The first essentials are to add to the organization all the producers of gold in the country, and to collect full statistics from all operators concerning costs, tonnages mined and treated, recovery, supplies consumed, and the number of employees, together with the wages paid, as well as ore-reserves and their assay-value, maximum capacity of mine and mill, and a statement of the increase in output that could be made by additional equipment. Such data should be submitted to the Secretary, or to any member of either the general or the executive committee.

The sessions of the Conference lasted three days, and from first to last 96 delegates registered. These represented 11 States, and included managers and owners of the majority of the large gold mines of the West. In addition to the routine business, a general discussion of the status of gold mining and the relation of the domestic gold production to national finance illuminated the proceedings. J. F. Callbreath, secretary of the American Mining Congress, pointed out the importance of sustaining the industry, in order that our national credit might not be weakened. Unless there is an increase in the security on which our governmental obligations are based, financial difficulties must follow. The effort now being made to secure the co-operation of the Government in maintaining the industry of gold mining is as important to the bankers and financiers of the East as to the miners themselves. There was no augmentation of output even in the pre-war period, when the relation between the costs and the gold recovered was favorable. This makes it more easy to comprehend the extraordinary decline of the industry. He was confident that the officials at Washington were fully aware of the gravity of the crisis, and that they would lend ready assistance to the movement. Carl C. Plehn, Professor of Economics in the University of California, presented an analysis of the function of gold as the basis of currency and national credit, and showed how important were the seemingly small additions to our gold reserve derived from our annual output. The great stock of gold in the Treasury is the foundation of our credit, but as the obligations increase it is these marginal additions that relieve the strain and prevent the rupture of confidence, just as a small marginal addition to the strength of steel will enable it to carry its load with safety. The rise in prices has not been the result of a suspension of specie payment, since, in effect, there has been no such suspension. The phenomenon has been due to the natural increase of prices due to the suddenly enlarged demand, or, to look at it from another viewpoint, it is because of the rapid spending. A large demand over a moderately long period makes a firm strong market, but does not raise the cost of supplies as does the same demand concentrated in a brief period; there is a time factor in market quotations, as well as a mere quantity factor. The high prices caused by the War must not be confused with the quantity of gold in the vaults, but the expansion of this reserve is essential to strengthen the foundation of credits. Governor Boyle recalled Lloyd George's assertion that gold is the "third line of defense," and impressed upon the Conference the need of presenting a case to Washington that should be sustained by ample statistics to prove the contention that gold mining would dwindle to insignificance without Federal aid, and that the request should be definite, and economically sound, practical, and fair. Important contributions to the discussion were given by John Clausen, vice-president of the Crocker National Bank, San Francisco, G. McM. Ross, Whitman Symmes, C. E. Lewis, William H. H. Hart, John A. Fulton, W. J. Loring, Bulkeley Wells, and others. The party visited the Comstock mines at Virginia City, and the courtesy of a dinner at Carson City was extended by the Nevada Mine Operators Association.

In the Brinell ball-test for hardness, a hardened-steel sphere 1 cm. diameter is pressed into the surface of the material. Brinell's hardness number is the quotient of the pressure (3000 kg. for hard metals and 500 kg. for soft metals) and the area of the surface of indentation. It is expressed in the equation $N = P/2\pi tR'$, where $N =$ hardness number, $P =$ pressure, $t =$ depth of impression, and $R' =$ radius of curvature of indentation. Since the relation between the load P and the depth of impression t is constant for any one metal, Martens suggests the ratio of P/t as a measure of hardness, and the hardness number as the load P in kilogrammes necessary to indent the material an amount t equal to 0.05 mm. Devries gives the following values for the hardness-numbers of metals:

	$\frac{P}{2\pi tR'}$	$\frac{P}{t}$
High-carbon steel	641.0	4550
Manganese steel	179.0	641
Cast-iron	149.0	538
Bessemer steel	188.0	428
Tool steel	289.0	1230
Copper	89.5	235

A fairly close relation exists between the hardness-number and the ultimate tensile strength of metals. Thus, Devries gives the results for alloy-steels as follows: tensile strength, S_M (lb. per sq. in.) $= 20{,}000 +$ hardness-number times 103), in which the hardness-number is the load P (in kg.) required to indent the material to a depth of 0.1 millimetre.

James Douglas

The Editor:

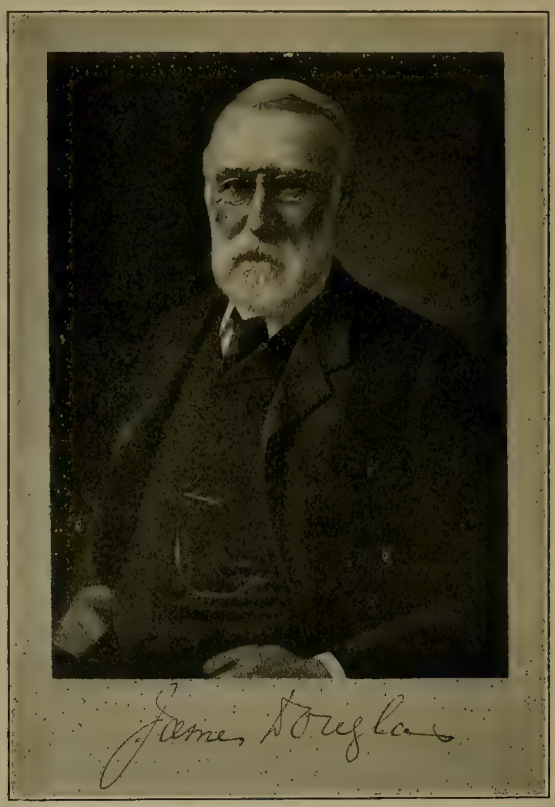
Sir—You ask me to send you some word about my dear friend, the late James Douglas. Absence in Canada and other things have prevented my earlier compliance. Now I must come after those who eloquently and justly have contributed, editorially and otherwise, to the growing volume of appreciation, and have compiled the long list of his achievements, and publications, and of the distinguished honors heaped upon him. Even the lists of his many and generous benefactions have appeared, though while he lived no one knew the tale of his private charities, or the number of the men to whom his advice—his willingness to put himself out for them—have meant success or at least encouragement and inspiration.

In writing of James Douglas, the man, one cannot yet lift the veil that covered to most the entrance to the sacred precincts of his home life. Thoughtful, considerate, affectionate, he was an ideal father and husband. Outside, he was not a man who wore his heart upon his sleeve. But in the intimacies of long journeys, over plains and mountains, in the hours by a fireside in some mining camp, one came to know him and to marvel at him. At other times, the strains of some great music, even the song of some woodland bird, or some stupendous vision at sunset, would move him until he would reveal the tenderness and great-heartedness of his poet's soul.

I have doubtless told previously some instances of his tenderness for the little brothers of the wood and field. He loved all Nature; was an enthusiastic fisherman, a very centaur on horseback, a hunter who killed his first moose at the age of ten; and yet he was as tender as a woman to his faithful dog and would not harm a fly.

One day he was examining some outcrops which had been prospected. In the bottom was a pool of shallow water, and in it a half-dozen toads which evidently had been trapped in their adventure across the country. "Oh dear, Ledoux," he cried, "what shall we do? We cannot leave them there; they will starve to death!" No ladder was available. He searched the bank until he found a fallen tree of suitable length, and we dropped the end into the pit. Down he went, and then began a strenuous chase for the agile captives. Not until he had caught them all and tossed them up for me to remove to a distance did he clamber out, muddy and hot, but happy. I have seen James Douglas in times of stress, for I knew him in the days of Phoenixville. I have seen him in action when deciding some great problem, and have seen the fire of his anger and the withering scorn with which he met some evidence of fraud or trickiness in professional or business competition. But I like best to remember his face as he rested in an old sedge-grass field after rescuing those toads.

I have told and could multiply instances of his generous giving from his store of acquired wisdom, when help was needed. Again, I will repeat: Many years ago I was sent to report upon a process employed by a



smelter in Wales. Douglas was in London and offered to go along. After we had seen that portion of the plant which was of especial interest to us, and which the proprietors were obliged to let me see, we were hurried through a part of the rest of it, and saw a small converter over which the superintendent and his men were perspiring. It was almost, if not quite, frozen up. Douglas stopped, much to the disgust of our committee of guides, and asked what was the trouble. Reluctantly, they told him that they were experimenting in bessemerizing some copper matte with the view of substituting that method for treatment in reverberatories. He looked

the thing over and asked the pressure of the blast. They said "Four ounces." "Four ounces!" said Douglas, "No wonder it froze on you! Run it up to four pounds." We went on, leaving the superintendent muttering: "If she freezes with four ounces of air, she'll go solid at once with four pounds." But apparently he tried it, for when we reached our hotel in London, he found a telegram from Swansea saying: "Converter working beautifully. Many thanks for your advice." Somewhere among Dr. Douglas' papers is perhaps still to be found the resolution which the directors of the company passed, officially thanking him for the great assistance he had given them. Doubtless this was only one of many similar experiences. I can recall the statement of the former superintendent of a Colorado smelter that a casual suggestion of Dr. Douglas enabled him to put a silver-lead-zinc mixture through his cupola, which previously was considered impracticable, if the values were to be saved.

Dr. Douglas disclaimed any knowledge that would cause him to be considered a 'specialist.' In fact he once wrote me:

"I made my reputation as a mining engineer and metallurgist in spite of the fact that the only scientific lectures I ever attended were in a course on chemistry when I was studying medicine. I think that the lesson of my success, such as it has been, demonstrates that great enterprises are often best controlled by managers who have a general, wide, technical knowledge, *but are not specialists,* and who have had the advantage of sound literary educational training. The effect of specializing of any kind is to contract a man's outlook, though it may make a good student of him."

He was a broadly educated man, a musician—a dreamer if you will; but his visions became realities, his dreams came true. They were materialized in the adaptation or invention of processes and bore fruit in generous human treatment of men. They are perpetuated in the monument we call the 'Copper Queen.' His ideals there survive and under the guidance of associates, and successors trained in his school, James Douglas will never need a shaft upon the slope of Mount Herman, Quebec, to perpetuate his memory. Standing on the hill of Bisbee, or upon the plain at Douglas, and noting not only the buildings containing the great plants, the yards, the busy tracks, but the libraries, hospitals, schools, and Y. M. C. A. halls, one may well repeat what was said of another great man: *"Si monumentum requiris, circumspice."*

ALBERT R. LEDOUX.

New York, July 29.

To Stimulate Gold Mining

The Editor:

Sir—Now that the Allies' offensive appears to be well in hand I wish in all seriousness to make the suggestion that some good dollar-a-year man like Herbert Hoover or Charles Merrill be requested to produce such gold as the United States and our Allies may require. There should be an adequate salary attached to the position. I was struck while wandering around corridors last week in Washington with the large number of mining men in war work—all kinds of bureaus and metals except gold. The readiness of the public and general appreciation of the situation is abundantly proved by the movement in Alaska Gold stock. It is a certainty that with one half the Government backing that has been freely and wisely accorded the Food Administration, war savings, enlistments, etc., the gold output of the U. S. can be trebled within 20 to 24 months by the single method of more intensive operation of existing producers. The Government will have to buy and own the added equipment. The details would simply provide for amortization and removal. Interest rate could well be that being paid by the Government. Labor-saving devices can solve the help question.

F. W. CARNAHAN.

San Francisco, July 26.

The Editor:

Sir—In regard to the War Minerals bill and a greater production of gold, the fact must not be overlooked that there are thousands of prospects and small mines in the West that prospectors and owners are holding in the expectation of selling to capitalists. As a rule the owners cannot sell them because there is not enough development done or value in sight for the mining engineer to recommend them.

We all know that a gold mine starts as a prospect and that most mines are made. The Government should put at least $5,000,000 (of the $50,000,000 that is to be appropriated for the War Minerals bill) to help the production of minerals in furnishing and building small mills for the small mine-owner, on the following plan: The mills to be of the portable type; several different kinds of these mills are made in California, ranging in capacity from two to ten tons daily, costing from $3000 to $10,000. These mills are so constructed that anyone with a little experience can run them. Several hundred of them on some of the most likely prospects would give a great stimulus to the production of gold and of other minerals. These mills should be put up and sold to the small mine-owner at cost, on time, to be paid for at the rate of about 10% of the gross returns. On this plan the Government would not be giving anything away, but simply loaning the small owner, like helping the farmer to put in his crops. One thing is sure, these mills would be used if they would only pay expenses while the owner was developing his prospect. It is a wonder we have had nothing of the sort started in this country long before. Some years ago such a scheme was tried successfully in New Zealand. The little mills were paid for in two years. [This system has been extensively adopted in Australia.—EDITOR.]

Most of the large smelters will not handle the ore from small mines at present. Gold production is on the wane and to revive it every method should be tried, such as a $20 bonus and no taxation. There are hundreds of these prospects and small mines here in the West and South that would pay on a small scale, worked by the owners,

with all overhead expense cut out, and helped by small Government mills, as suggested. Men, food, and gold are needed to put the German where he belongs. We have the men and the food; we can get the gold by going after it.

FRANK P. DAVIS.

Fluorine, New Mexico, July 31.

Interesting Minerals

The Editor:

Sir—Two interesting mineralogical occurrences have come to my attention recently.

The one is a specimen of native gold on native copper found by H. M. Lindsey of Ray in the Jim Crow mine, Grant county, New Mexico. The native copper is an irregular nugget of approximately 0.4 in. diameter and 0.2 in. thickness. It is partly coated by cuprite, on top of which malachite has begun to form. In a depression of this nugget there is a bleb of gold, about 0.1 inch in all dimensions. This shows distinct crystal-faces, which, however, have been marred by wear and indiscriminate knife-scratches. The Jim Crow mine explores a fissure-vein in andesite, similar to and near the old Carlisle, or Steeple Rock, mine.

The other mineral I found in the Gila Canyon Con. Copper Co.'s property four miles north of Hayden Junction, in Pinal county, Arizona. Here copper, dissolved from eroded limestone-beds, has partly been precipitated in quartzite and pyritiferous diabase. In a certain horizon of the diabase the pyrite is displaced by a beautiful ruby-red cuprite. As far as the narrow cleavage-planes permit, the cuprite assumes crystalline-structure; but besides replacing the pyrite it is also pricipitated on dendritic infiltrations of manganese oxide. These dendrites of cuprite are very beautiful, but the rock is so full of latent cracks and fractures that it is almost impossible to save good specimens.

W. TOVOTE.

Venice, California, July 27.

Vital Minerals

The Editor:

Sir—Vital as powder and ball, or beef and flour, for the successful prosecution of the War are a number of metalliferous ores, which are now mostly unworked, the mines lying idle throughout the United States; and the cause is to be laid on Congress, for mutilating and eliminating the stimulative value of the War Minerals bill, caused to be enacted by men who knew what they were doing. At present we have nothing that we can afford to waste, neither time nor supplies, so I will go straight to my point and leave detailed explanations to more capable men. I wish to call attention to the effect of the first War bill, and the 'blue and black flag' one later enacted by the House of Representatives. The bill as first drawn gave some encouragement for a gamble in the ores which are most needed, and mining men had gone to some expense to furnish those ores, and there would have been to have kept the price normal or reasonable. It is well known that there have been a few gold mines closed down; some are running on scant profit, and some nearly at a loss, because of the high price of supplies, which puts a low value on gold bullion. Now, a lot of those gold mining companies were going into the furnishing of the more vital metals, but since Congress spoiled the first minerals bill they have backed down, for no man wants to make a failure, and they have come close enough to that with gold. There are no more faithful citizens than the mining men, and what would our Army be without the mining engineers? I fear German propaganda is still in the air, and cannot be very quickly overcome by patriotism either, but it will be cleaned out, for the American people are smart, and only need to be aroused.

PROSPECTOR.

Robinette, Oregon, June 10.

The Miner and the Tariff

The Editor:

Sir—The economic conditions created by the War have proved that we have all kinds of metals and minerals, because the lack of shipping facilities has prevented manufacturers from supplying their needs from foreign sources. With the rise in prices due to the War, the American miner has been able to prospect, develop, and mine deposits that were supposed to be worthless. We now know that we have many of the most necessary minerals in almost inexhaustible quantities. The only requisite is a fair price for them. After the War is over and shipping facilities are again in operation between the cheap-labor countries and the United States, prices will go back to where they were before the War, perhaps lower in many instances; but if protected by a sufficient tariff their production will continue prosperously. It is up to the producers of the different metals and minerals to form a strong association to prepare for after-war conditions. If they do not, their business will become unprofitable and it will be necessary to discontinue, and thus permit their present business to pass to the cheap-labor countries of the world, principally South America and Asia.

The miner is unable to perfect such an organization. The users of the metals and minerals will not. It is up to the American producer. The organization should be national and include all the producers of such materials. They should do as the steel, wool, and other industries have done, namely, educate the public concerning conditions and requirements. If this is done, they will get the necessary protection; without it, they will not.

The assistance of the tariff has made possible most of our important industries. In our present crisis it has saved them. With a just tariff why should not other industries become equally as important, such as the mining and refining of antimony, chrome, tungsten, and magnesite.

Mr. Producer, save your business. Start the work while you can and your business can support it. It will

cost you a little money. Start and develop the proper organization or prepare to quit business, which otherwise you will be forced to do after the War.

San Francisco, August 10. W. K. Forest.

Hydraulic-Mining Debris

The Editor:

Sir—In the abstract of Gilbert's paper given in your issue of March 16 appears the statement that the capacity of water (as a carrier of debris) increases with discharge, and that when discharge is increased, the capacity per unit of discharge is also increased. This is the conclusion reached by Gilbert from the experimental work described in his previous paper No. 86 of the series, where he derives the formula

$$\text{Capacity} = K(\text{discharge} - k)^n$$

the exponent n being greater than unity. It is the case that the values of n derived from the original experiments varied above and below unity in the different sets.

I have devoted considerable study to the data presented by Gilbert in Paper No. 86, rejecting the adjusted values of capacity and obtaining them by interpolation from the original experimental data, and I am forced to the conclusion that a formula of this type is radically wrong.

In the above formula the increase of capacity relative to discharge progresses faster than discharge when n is greater than unity, at the same rate when n is unity, and slower than discharge when n is less than unity. The graphs of the three equations where n varies in this way show the curve concave upward, straight, or convex upward, as n decreases.

A careful examination of the plots of the original data convinces me that the typical curve is concave upward to start with; as it travels away from the origin the rate at which capacity is increasing faster than discharge becomes less and less and the curve reverses and becomes convex upward. In some cases the region covered by the experiments is such that only the earlier portion of the curve can be drawn, and there is no indication of its tendency to reverse. For these cases Gilbert derives n greater than unity. In other cases the curve begins to reverse close to its origin and here he derives n less than unity. As there are not usually more than four points on the curve obtainable, and experimental error is fairly considerable, a curve that shows the two portions can easily be drawn as a straight line covering the points fairly well and giving n as unity.

It is my belief that finally the curve reaches an apex and begins to descend, but the data do not extend to sufficiently high discharges to verify this. If it is so, it means that for given conditions of slope and channel-width there is a maximum capacity that cannot be exceeded, and can be considered in connection with the statement (also Gilbert's) that capacity can be reduced to zero by making the channel narrow and deep.

An algebraic expression for this kind of curve is given by $y = -ax + bx^2 - cx^3$ the apexing of the curve being provided by making the sign of the third term negative, and the observed fact that a certain definite discharge is necessary before capacity appears at all by giving the first term a negative sign also.

The relation of duty to discharge is obtained by dividing the capacity equation by x, giving

$$u = -a + bx - cx^2$$

the signs of the terms remaining as before, the locus of the equation being a parabola with an apex illustrating maximum duty for a particular discharge under the fixed conditions of width and slope. In the above equations y represents capacity, u duty, and x discharge. The maximum duty is reached with a discharge less and probably considerably less than that giving maximum capacity. In some of the experiments its region is covered by the data.

I must confess I have quite failed to establish the constants a, b, and c, for any of the experimental sets, such a task being extremely difficult on account of the few points on the curve obtainable and these points themselves being derived by interpolation from data that allow a good deal too much freedom in this respect.

It is interesting to recall an observation of Overstrom's that maximum duty is associated with a certain discharge per unit of width. My examination of Gilbert's data does not confirm this, but neither does it disprove it, the data in the neighborhood of the maximum duty being extremely shaky. If the Berkeley experiments are resumed it is sincerely to be hoped that a series will be run testing the variation of capacity or duty with varying discharges on a fixed grade or slope under flume conditions.

R. T. Hancock.

Jos, Northern Nigeria, June 4.

The Status of Gold Mining

The Editor:

Sir—Referring to my letter of July 27, which was published in your issue of August 17, the statement made therein as to the action of the executive committee of the California Metal Producers Association is in exact accord with the facts.

Since the letter was written, however, three members of the executive committee have been in attendance upon the American Gold Conference at Reno, Nevada, and have become convinced that direct financial aid extended by the Government to the gold-mining industry would not only be of benefit to the industry, but could be extended in such a way as not to cause damage to other financial interests. I have little doubt that were the other members of the committee to have the advantage of the same arguments that were advanced at Reno the majority of them would also be convinced. This being true, I think it safe to say that so far as the California Metal Producers Association is represented by its executive committee, it would now, if a vote were taken, be in favor of some form of direct financial aid.

Albert Burch.

San Francisco, August 19.

ITALIANS, AUSTRIANS, MEXICANS, AND OTHERS LISTENING TO A LIBERTY LOAN TALK ON THE PENNSYLVANIA RAILROAD

A New Bonus Plan

By A. M. HECKMAN

A fixed scale of wages, as used in the copper districts of the South-West, is fundamentally wrong in principle, because it does not take into consideration the individual skill of the workman, his age, length of service, job, or any of the factors that go to make up his real value to the organization in which he is employed. For a company employing a large number of men, however, it seems to be the only system that is practicable. Undoubtedly some of the copper-mining companies could afford to maintain a higher wage-scale, but it is also true that if a higher scale were forced upon all the companies, many of them would find it necessary to close down.

A NIGHT-CLASS IN ENGLISH FOR FOREIGN-BORN EMPLOYEES

There would be less copper produced; there would be less work for the laboring man, and the surplus of labor caused by such a move would be detrimental to him.

Again, it is not possible for mining companies in the same or contiguous districts to individualize wage payments. This would cause a greater migration of labor—a surplus in some places and a deficit in others.

The high rate of labor turn-over caused by the migratory type of men found in mining districts has been a source of considerable expense to the industry, and gives cause for serious thought. There is no question but what the cost of labor turn-over has been increasing rapidly, owing to the loss of skilled labor to shipyards and other Government projects, and the replacement of that labor by men totally unskilled in mining. There is also no question but what a man who has been in the employ of a company six months or a year is worth more to that company than a new man; his individual efficiency and earning power is greater, besides the fact that he has, to some extent, reduced the cost of labor turn-over. Up to a short time ago, however, there has been no way in which this individual effort and skill could be substantially recognized.

In this connection, in January 1918, the Phelps-Dodge Corporation, the Calumet & Arizona Mining Co., and the Shattuck-Arizona Copper Co., operating in the Warren district of Arizona, announced that every man who had been in their service continuously underground for one year would receive $100 bonus, with $50 for six months service. Surface workers were given $60 and $30, respectively. This bonus was not given as a reward for staying one year with the company, but rather as a recognition of individual skill. Fortunately, the Warren district has not been subject to the high rate of labor turn-over to the same extent as many other districts, because of the unusually good conditions of the camp, but the companies saw that a situation was arising that would need attention, and, as is characteristic of them, they sought a solution of the matter before it became serious. At this time the Copper Queen branch of the Phelps Dodge Corporation paid in bonuses $181,120 to 2286 employees. The average number of men on the payroll for the year was 3773, so it will be seen that two-thirds of them had been with the company six months or a year, and that but one-third was of the migratory type. This is especially significant when it is remembered that it was in July of this year that a general strike was declared.

The bonus plan, as declared at that time, was intended to be a permanent feature. The following statement was issued recently by the three companies jointly.

To Employees of Copper Queen Branch, Phelps Dodge Corporation:

When bonus was paid last January we stated that we hoped later that it would be permanent. This announcement has recently been made, and we desire to present the plan more in detail as follows:

1. After July 1, 1918, every employee who has remained in the service of the company continuously for one year will receive a bonus of $100 on completion of his year's service, and for each additional year of continuous service an additional $10 will be paid until the annual bonus amounts to $250, when no further increase will be made in the annual bonus.

2. The bonus is in no way related to the wage-rate, or kind of work done. It is a flat bonus for continuous service and the same amount will be paid to every employee regardless of his daily wage, monthly salary, or nationality.

3. In order to receive the bonus you must remain continuously with the company, but time lost on account of sickness or accident will not count against you after you return to work. Also you will be allowed to lay off for a total of 30 days during any year's service period, provided you obtain written permission from your boss or foreman and hand it to the employment agency before you leave. Your lay-off may be taken all at one time or may be taken a few days at a time, but must not be for more than 30 days total in any service-year.

4. Every man receiving a bonus last January will have his second year's service begin January 1, 1918, so he will be entitled to a bonus of $110 at the end of this year if his service is continuous according to the rules. Men who began work with the company after July 1, 1917, or since January 1, 1918, will be considered as in their first year's service until their year is completed. To illustrate, if you began work, say on July 5, 1917, or any other date after July 1, your first year's service will be completed on July 5, 1918, or a year after you began work, and if your service is continuous, in accordance with the rules, you will receive your first year's bonus of $100 on the next pay-day following the completion of any year's service. Those of you who began work last July, and have continued with the company since then have but a short time before your first bonus is due.

5. It is important that you observe the rule covering absence from work. If you lost time because of sickness you will have a company doctor and the records of our medical department will show that fact. If you lost time because of accident, the records of the medical department will show that also. If you desire to lay-off, even for one day, you should obtain permission from your boss or foreman, on the proper form for that purpose and hand it to the employment agent so that your record there will be clear.

PHELPS DODGE CORPORATION,
COPPER QUEEN BRANCH.
G. H. DOWELL, Manager.

It is not claimed that this plan represents the ideal method of payment for increased skill and efficiency: the ideal method would be based on individual effort and efficiency. While it is possible for a company with a full knowledge of its own business to measure individual earning-power and value, the factors governing such a thing are complex. Then, too, if it were announced to the employees of an organization that they were to be paid on individual ratings, the lack of understanding on the part of the workman would at once arouse suspicion.

Effect of Oxygen in Precipitating Gold From Cyanide Solutions

By THOMAS B. CROWE

*In regard to the precipitation of metals from cyanide solution by zinc, we hear little of the part oxygen plays in it. Caldecott says: "As the dissolving of gold is essentially an oxidation process, so its precipitation is one of reduction." All who have studied or worked with cyanide solutions will agree that Caldecott's statement is true. In the cyanide work in the mills of the Portland Gold Mining Co., oxygen always has been found to be the greatest enemy to precipitation.

A few years ago, while making some experiments on the effect of pressure upon the rate of dissolving gold from Portland ores, I made some bottle tests under vacuum. The results were surprising, and showed that under vacuum practically no gold dissolved, which confirmed my belief that Elsner's equation was true and also led me to investigate the amount of dissolved air carried by solutions at atmospheric pressure. The experiment consisted in partly filling an acid-bottle with mill-solution and connecting it by a rubber hose to a vacuum-pump. When the vacuum was suddenly applied, a cloud composed of thousands of small air-bubbles rose from the solution, showing qualitatively the amount of dissolved air contained in the solution, and also proving that the relief of atmospheric pressure on the solution permitted this dissolved air to escape. In studying the literature on the subject, we note Henry's law—"The amount of gas dissolved by a liquid is proportional to the pressure to which the gas is subjected." We find that at atmospheric pressure, water dissolves from 2 to 4% of air by volume. We also find that when air is dissolved by water, owing to the different coefficients of absorption of oxygen and nitrogen, the absorbed air has about 35% oxygen and 65% nitrogen, while ordinary atmospheric air is about 21% oxygen and 79% nitrogen. Mill solutions, then, contain not atmospheric air, but a per-oxidized atmospheric air, which is good for oxidizing but injurious to the reduction-process of precipitation.

In the early days of zinc-dust precipitation, the dust was sprinkled over the top of a tank of solution while under agitation; large quantities of zinc were used and the solution-tailing was far from what was desired. Later, Merrill's improved method came out, the principal characteristic of which was the exclusion of air from contact with the precipitant and the precipitate during precipitation. Merrill's method was a great improvement over the old scheme, allowing a material reduction in the quantity of zinc used, with much lower barren solutions, and plainly showed the effect of oxygen in former work.

Having had the sad experience of allowing free air to pass with my solution through the precipitation press, and knowing that Merrill's process had been an improvement over the old open-tank process, I naturally reasoned that the removal of the dissolved air from solution would be the means of further benefiting precipitation, providing a vacuum could be practically applied to solution, prior to, or during precipitation. Laboratory tests confirmed my theory. Large tests were tried, with the result that the zinc consumption has been cut in half. Having been successful in reducing the amount of zinc used, and as the price of cyanide kept soaring, we noted in a scrutiny of our former work that, for dissolving purposes on our particular ore, the cyanide-solution strength was higher than necessary; in fact, the solution-strengths in our mill had been reversed—the strongest solution was the barren; and, this being used as a wash on the filters, occasioned high consumption of cyanide. The high strength of the barren solution was caused by the necessity of adding lump-cyanide at the head of the precipitation presses to ensure low-grade solutions to be used in washing.

On the installation of the vacuum system, perfect precipitation could be maintained without the addition of lump cyanide, and today our mills are running with the highest strength of solution in the agitators and not in the barren-tank. This, together with a generally lower strength of solution in all parts of the mill, has allowed a material reduction of cyanide consumption.

Table I shows the amount of cyanide and zinc used before and after the installation of the vacuum precipitation.

	Solution precipitated, tons	NaCN per ton ore, lb.	Zn per ton ore, lb.	Zn per ton sol., lb.
1915	503,819	0.331	0.407	0.174
1916	536,455	0.320	0.369	0.150
1917, half-year	249,988	0.175	0.191	0.084

In the years 1915 and 1916 ordinary zinc-dust precipitation was used, and in 1917 vacuum precipitation. How often have we found, when working with zinc shavings, that the only remedy for poor precipitation, excepting the addition of lump cyanide at the head of the box, which has its limitations, is a clean-up or redressing of the box. Assays of the effluents from the different compartments of a box during a period of good precipitation generally reveal the fact that each compartment in the series is doing some work, there being a gradual reduction of the value of the solution as it progresses from compartment to compartment. A similar series of assays taken during a period when precipita-

*Abstract: Trans. A. I. M. E.; paper to be read at Colorado meeting, September 1918.

tion is only fair, the box being inclined to give erratic results, shows that the first compartments of the series are doing but little work, the burden consequently being thrown on those compartments lower in the series. A third series of assays, taken when precipitation is bad, generally shows that, not only is no precipitation occurring in the first compartments, but that the first compartment is giving up its gold, the dissolved metal being carried to the lower compartments and sometimes entirely out of the box. Decreasing the rate of flow of the solution through the box sometimes helps, and increasing the strength of cyanide also gives temporary relief, but a re-dressing of the box seems to be the only real remedy.

During precipitation, two opposing forces are continually at work: a precipitating and a dissolving force. The precipitating force is a reducing action and is caused by the dissolving of the zinc, which creates an electromotive force and evolves hydrogen. Nascent hydrogen seems to be the active agent that causes precipitation. The second, or dissolving force, is an oxidizing action, its strength being a function of the amount of oxygen carried by the solution.

Reducing-agent hydrogen and oxidizing-agent oxygen are determined enemies, and cannot live together in the same solution. When nascent hydroyen, caused by the dissolving of zinc in cyanide solution, is generated its first work is that of combating its enemy, oxygen, combining with it and getting it out of the way. After this is done, it takes up the rôle of precipitation and plays its part. When large quantities of zinc are dissolved and plenty of hydrogen is evolved, as is the case when lump cyanide is added at the head of the box, the effect of oxygen becomes insignficant, but when the strength of the cyanide solution is low and little zinc is dissolved, then the oxygen in solution may gain supremacy over the evolved hydrogen and result in poor precipitation or, in extreme cases, in dissolution of the precipitated gold. Especially is this true when the zinc has been in use for long periods and the first compartments are rich in gold and poor in zinc. A freshly dressed box presents more zinc-surface and, in a cyanide solution of a given strength, has a certain power to reduce and precipitate, this power becoming less and less as it does its work. This work consists of an exceedingly small job of precipitating and a large job of counter-acting the effects of oxygen contained in the air dissolved in solution. Why, then, allow this enemy of precipitation to pass with the solution into the zinc-press or box, when it can so easily be removed by the application of a vacuum during its flow?

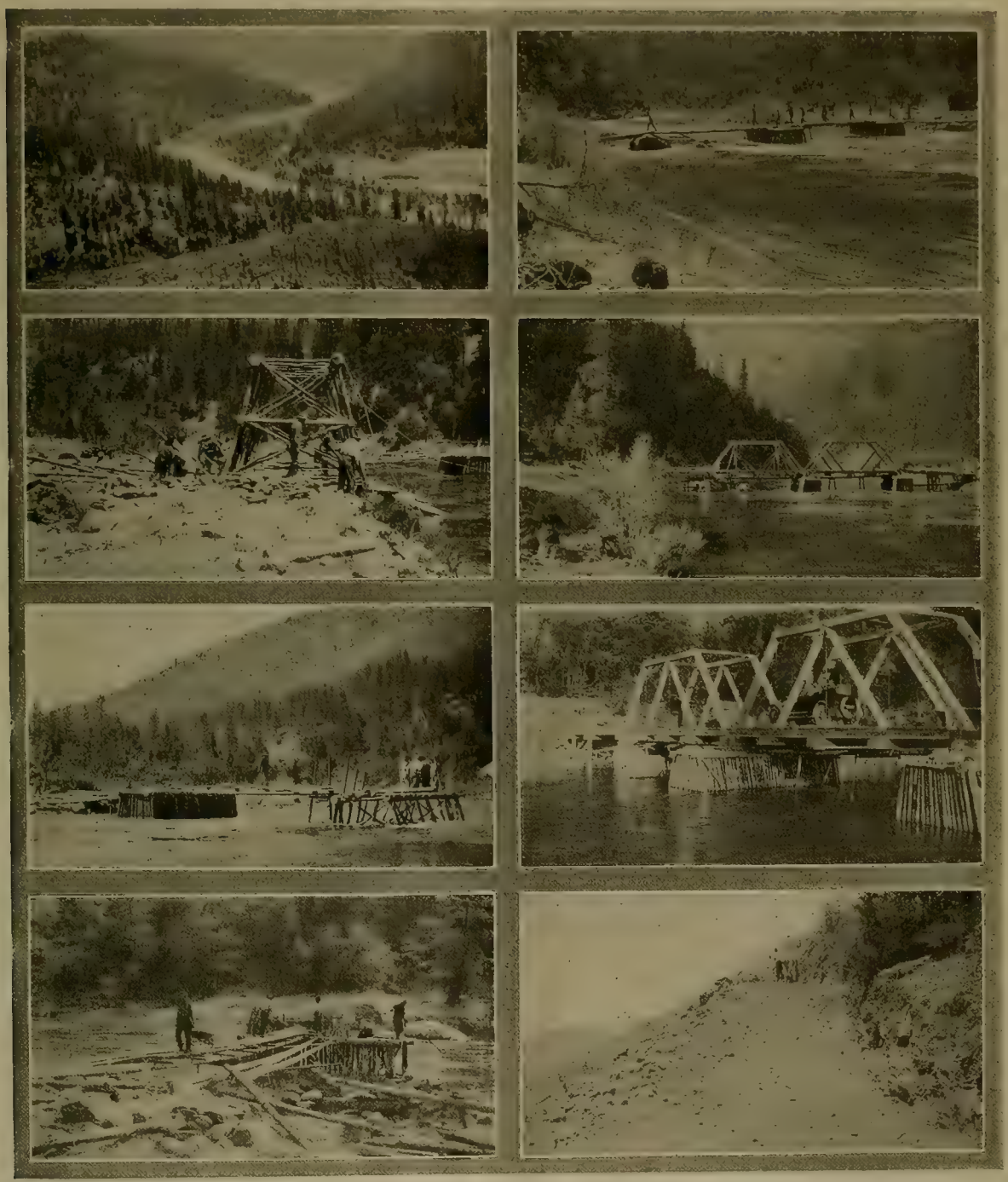
When the air in solution is removed prior to precipitation and the de-oxidized solution is run or pumped through the precipitating system, only the burden of precipitating is put upon the zinc and we find, when this is done, that a very weak electro-motive force is sufficient to effect precipitation, which means that one can operate both with weaker cyanide-solution and with smaller amounts of zinc, producing a precipitate of higher grade with less cost for cutting down and refining.

Bridges and Roads in Mining Districts

The search for chrome, magnesite, manganese, and other secondary minerals has revealed most of them to be in hilly regions away from road or rail. In all cases some means of transportation must be arranged, according to local conditions and the size of the deposit. One mine may be large and rich enough to justify the construction of several miles of expensive truck-road, or even railroad, while a mile of trail-making might be more than another could stand. Whether a man sled his ore down a hill at a cost of $10 per ton or build a road for $2000, over which it will cost him $2 per ton to haul it, will depend on whether he has at least one-eighth of 2000 tons to haul. The cost of roads and trails varies so greatly in mountainous regions that it is not advisable to begin any important construction of this kind without a survey and an estimate of cost by a competent local engineer. In all cases, the ingenuity of the mine-owner and the best use of local materials counts largely.

Sometimes it is necessary to construct a bridge over a stream between a mine and a railroad, and it is with this phase of the subject that these notes are concerned. In Siskiyou county, California, near Hamburg on the Klamath river, 50 miles west of Yreka, is the Klamath chrome mine, for which Samuel H. Dolbear is consulting engineer. This property is said to have considerable possibilities, so preparations are being made to mine and haul a large tonnage of chrome. Sled-trails aggregating 2000 ft. in length were built to connect the deposits with the truck-road. From the ore-platform to the county road it was necessary to build eight-tenths of a mile of truck-road. Work will continue during the winter, as the county and the Federal government are improving the main road to the railroad, and an aerial tram from the mine to the south side of the river will obviate sledding over the soft ground. Between the sled-roads from this mine and the truck-road flows the Klamath river. Here it is 150 ft. wide, the flow of water being 10 ft. per second. On May 6, 1918, work was commenced with 50 men, in charge of E. F. Waldner, temporary quarters being established on the south side. Photograph No. 1 shows the character of the country at this point, and the bridge that was built. Plenty of lumber was available, all being cut at near-by points. The type of bridge is known as the Burr truss, standing on crib piers. Photograph No. 2 shows details and launching of the first crib. No. 3 shows the cribs in place. These were launched by pushing them into the river. Fastened to each crib were three steel cables, two on the north side of the river and one on the south side. They were connected to home-made windlasses, which were used in tightening. The men pulled the cables taut and moved the crib into its final position, afterward using the cables to hold the crib in this position until it had been filled with rock. When in place, the cribs were surrounded with lagging, simply poles driven to bedrock in the river. Then the cribs were filled with rock—photograph No. 4 showing this being done—the two holding a total of 135 tons. As will be

seen in No. 5, a convenient rock—believed to be a projection of the bedrock rather than a boulder—served in place of a third crib. On top of the crib foundations, stringers were laid, upon which the trestles or trusses were constructed, and the bridge decked with boards. The work has been entirely satisfactory. When water is high in the winter the bridge will be removed, the piers remaining, provision having been made to do this within a day. Then the aerial tram mentioned will be used. The first carload of ore was billed out in 60 days from the time work was started. The daily output is from 25 to 50 tons of ore; eighteen 2 and 3-ton trucks are used.



READING DOWN, PHOTOGRAPH No. 1 SHOWS THE CHARACTER OF THE COUNTRY ALONG THE KLAMATH RIVER, CALIFORNIA, AND THE BRIDGE THAT WAS BUILT; No 2 TO 7 ILLUSTRATE STAGES IN CONSTRUCTION OF THE BRIDGE; AND No. 8 IS A VIEW OF ROAD CONSTRUCTION ON A HILLSIDE.

A Letter From the Front

Somewhere in France, June 14, 1918.

Here I am again upon this momentous anniversary and showing no ill effects for the year passed since I left the States, a year ago today. There has been a lot crowded into the last twelve months—it seems as though I were a little kid when I landed and El Paso seems like another existence. We took a terribly long time to get moving; the months of marking time at exercises long familiar for the benefit of commanding officers, to whom it was new, filled an interminable period, but we are in it plenty now. The next twelve months will be fuller of events than the last have been and I hope the long-prepared-for job will be completed in a good and satisfactory style. Every day we hear of new divisions entering the line, to the north and east of us, with the French and with the British. We also hear, aside from the newspapers, that their conduct has been very good. The French have plenty of artillery and the number of our infantry regiments and brigades gives one hope that we will soon be a considerable factor. The divisions around the Marne, they say, have done well in the face of large forces, have taken the offensive after losses and hard usage. If the newspapers did not so magnify every encounter of a handful of Marines into the stopping of the German drive, we could judge better. We have been in actual service about twice as long as any other division in France, that is, in the lines; in fact, our present tour is fast approaching the French record for length, and in that time have taken our sector, which was unorganized, and made it strong and good. The work has been remarkable, considering the activity of the sector: trenches dug, wire put out, dug-outs and artillery and machine-guns put in. A vast task. My men take to it in a way to please one. Twice the Colonel has expressed himself as much pleased at their execution of difficult work. They are developing a liking for the spade, a good symptom, and one without which men are not soldiers. It seems as though we have hit on more than our share, as we have had to change lines or re-organize half a dozen times in different places. It is good for the men, for, strange as it may seem, it is impossible to give them enough work when they are in the front lines. The four-hour night is used to the utmost, but by day the men must lie hid in trenches not deep enough to stand up in. One meal a day suffices, the bread being saved with some meat for consumption during the following day. It is a hard life, but the men harden so that there is remarkably little disease. Occasionally a little trench-fever, quickly over, and a touch of diarrhoea; at most a dozen men a month constitute the list of ailments. There is much less sickness now than when we came up, in spite of a long hard *tour* [turn]. After a pause, during which I rap on wood, I can state that my losses have been comparatively light, the least in the battalion, due purely to good luck, as we have had one more *tour* in the lines than the other companies. L Company suffered most, as much as any two others, I think, in this battalion. Serg't. Brown died of wounds and I was sorry. He was a good, little man, not excessively powerful but faithful and conscientious to a degree. Others who were with me are also gone. Serg't. Bateman is back, having recovered from his wound. He is the best soldier I ever saw and was much needed.

I got back my application for the Tanks, approved by the Major, but disapproved at Regimental Headquarters and all the way up. Everybody's else was, so I cannot kick more than they. I should like to get a staff job, not office-work, but operations of a suitable sort. Staying in the line you never get seen, while the boys on staff will get a great boost when the corps and armies are organized. However, it is said that Gen. March is fixing to make all the swivel-chair boys serve and make good in the line before they can do staff, so that active service in the line will be a requisite. Maybe then some of the line people will get in. Let us hope for it. On the other hand, being not seen has certain advantages in my case, because I have been living for a month or so with only "full field," that is, what one carries on his back. The result is hard on the appearance. A week in the lines plays hell with the beard, and the chalk which is everywhere makes the clothes look like the mischief, a process not improved by sleeping in them and never changing. Yesterday I got a bath and general clean-up. Triniman heated a large can of water and I disrobed and bathed, using the leg of a pair of drawers for a wash-rag. Unfortunately they started shelling the town before I got done, and I was impelled to dive into my dug-out with nothing on but a coat of lather, to the great hilarity of the runners, as I had been bathing in an old chicken house across the court. Triniman followed with the can and I finished in security. He also washed my (only) shirt and I donned clean underclothes, and shaved. The result was all that one could wish. I also got a new blouse, discarding one bought at Leavenworth a year and a half ago. This is a 'Tommy jacket,' one of the English blouses being issued to our men. It is greatly superior to ours; for some reason our blouses are always cut badly, tight around the chest and arms, so as to hamper one just as much as possible, and as I am disproportionately shaped just below the shoulders I never get into an issue blouse. This is, however, comfortable and amply cut, and being unlined is cooler than our issue. A change of underwear also serves to reduce the number of guests to whom one is host. A new sector is desirable in that it is not so infected with lice, but the accommodations are not so good as in Lorraine and Toul, so one has to sleep in close contact with the men who are all lousy, so we all have 'em plenty. Six weeks without a

bath makes it hard to keep them down, but they have the advantage of being easy to catch, unlike fleas, and can be picked off one's undershirt on fine afternoons, "reading your shirt," the men call it. Also a bath and clean underwear will free one of them, so all will be well when we get into a back sector again. More unpleasant is a particularly tenacious variety of itch, 'scabbies,' which a good many have, but I have not got it, so do not worry. Also the lice are not so numerous as to prevent my sleeping, so they are really a minor annoyance.

I am at present nicely located, the best in weeks, Capt. Irwin of K Company and I having a deep cellar in the outskirts of a small town in front of which lie our companies. The first thing done on the abandoning of a town by its inhabitants is for the military to rush in and get all the beds, box-mattresses being the rule here, and carry them off to their dug-outs. I have a particularly good one, the cellar is roomy and Irwin has a striker [batman or unofficial servant] who can cook, so we do finely. Rhubarb is in season and in all the gardens and as most people do not know it by sight we have all we want. Gooseberries also are to be picked by the strikers and strawberries are ripening. The onion beds are reaching sufficient maturity and peas are nearly so. There is still a little lettuce and another vegetable like spinach [probably sorrel] is plentiful. Today the mechanics found a few handfuls of asparagus. So when we can build a fire we can occasionally augment our rations. Unfortunately my company is so ill-supplied with cooks that I cannot spare one for an officer's mess. K and I companies have strikers who can cook and in L the cooks cook also for the officers, but Triniman is only learning how to put food together. I ate about a week ago with Paul Ransom, who has the machine-gun company, and had one of the finest meals I have eaten in France, the work of his striker. First, a wonderful vegetable soup, picked up in gardens around; then lettuce salad with onions and chives; then canned roast beef (tastily disguised under a sauce made of canned tomatoes), cabbage boiled with bacon, French-fried potatoes, rhubarb sauce, and a sort of Brown Betty of dried apples. These with biscuits, jam, cheese, and wine made a meal to feed a field-marshal. A striker like that is worth many times his weight in gold. I have an excellent caretaker, though, who for solicitude for my comfort is unapproached. Triniman is the 'Shorty' of Pattullo's 'Going-In' article and is not much longer than a full pack. He washes my clothes, heats water, makes up my bed or my pack, warms my food, and looks after my things in a way that leaves nothing to be desired. He does not carry tales, either to or from, nor get familiar when living with me. Also, he takes so little space that he is very handy in close quarters. He is Cornish. Before the War he contracted work in mines in Butte and made $9 a day and he is far superior in intelligence and character to the general run, so that he is pleasant to have around.

The town in which we now are is an ordinary little place with a long name, recently quitted by its inhabitants and already totally ruined by the German big guns. In this part of France the buildings are all frame, lathed, and plastered with clay. They last if kept up, but a 210-mm. shell will blow down a block and the concussion of guns will crack them to pieces, unlike the durable and ancient stone of Lorraine. For some reason the Boche got the idea we had troops in the town, and he ruined it in an afternoon. It had a fine church and he shot all afternoon until he busted it down. When a big shell lights in a ruined building the dust goes up to the sky and timbers fly in every direction. We live rather removed so few shells have come near. In fact, the Boches have thrown tons of great shells into the place and never touched a man during our stay here. It is a perfect marvel how many shells it takes to hit a man—days of shelling and not a casualty. I have led my company into a position in column of file with nine paces between men so that they stretched to a great length and passed through considerable bombardments without a man being scratched. One soon gets to locate where they are shelling and how to avoid such places and to choose safe routes. I got relieved from a town a while ago, and just as we started back, they started to shell. The men were in file in a long string and I gave the word to run for it, and we ran through a perfect hail. Nobody got out of place or ran faster than the rest, and as soon as we passed the shelled area all fell into a walk and went on as orderly as one could wish. No one was touched, but such an affair is hard on the company commander's nerves. Things have been comparatively quiet recently and I have got a little needed sleep the last day or so. Sleep is the hardest thing for company commanders to get. The paper work is as bad as ever and the necessity of keeping permanent records in rear makes it doubly hard. Of course, all we could leave behind we stored before leaving our training-area and when they sent word to settle up an account for goods bought by the company in Syracuse last November or something like that, it was impossible, a thing the higher-ups never thought of. Also when an order reaches you at dawn to send in the names of all graduate chemists by noon, it is hard to do so when the company is all in little disconnected trenches that cannot be reached by day; is it remarkable that the answer is probably "None in Co. M"?

Continued next day: I got a good sleep all right today. I went to bed about 6 this morning and slept till 2 this afternoon. Rose, washed my hands, face, and feet, and breakfasted. We had steak, French-fried spuds, doughnuts, prunes, cold slaw, jam, and bread, a damn good meal. So I am now ready for the day. We stay such a short time in one place that we never get settled, four to eight days, generally four. In quiet sectors where eight or ten days is the rule you can bring up stuff and have your bed-roll, but where you shift around so often it is not worth while trying to be comfortable or to make a good place. In the case of the men, we always make them work as much as possible making funk-holes and shelters, but beyond such quarters I do not try to get anything. Ordinarily a deep narrow trench is as good a thing as there is against shell, shrapnel, or bullets. If it is deep and narrow, shrapnel cannot get in and it takes

a direct hit by a shell to get a man in the bottom. And it is unbelievable how many will hit close without going in. Often they will hit the parapet and cave the place on the occupant, but the others pull him out and he is O. K. Of course, big stuff will blow up the whole thing, but it is costly shooting 6-inch at a crooked trench concealed by grass. When you have time you make dug-outs; that is, we do. In one place we were in a support position near a great ruined farm. We went there and got out timbers and set to work on dug-outs, real bomb-proofs made by mining. These are made by passing up the earth and timbering as you go. We started eight of them, two for each platoon, each with two stairs. In four nights and sometimes by day we got the stairs down 20 to 40 ft. and had started on the chambers at the bottom in the deepest ones. The trouble is that not all organizations work well and pepless people come along and take over and never carry on your work. We went into one place where a battalion had been eight days, following the French. They were very close to the Germans, only 40 yards in a wood and had not done a thing. They had little disconnected pieces of trench over about 200 yards of front, no shelters and no wire. We connected up the trench, put in wire—a ticklish job at that range—and started dug-outs, so that the next people in were O. K. Moonlight is a fine thing for work in the rear echelons and for carrying parties and chow details, but for wiring and digging front-line trenches a good black night is what one likes. In going into a new place, the men are spread in twos and threes across the front to be covered as early at night as possible, and start to dig in. By dawn they will be down three or four feet. They lay sticks or tools across, a poncho over these and grass, etc., on top, as a screen from the sun and aerial observation. This is improved by deepening and undercutting the parapet.

I saw Hawkinson recently when I relieved him. Two days before he had led the extreme flank of an attack. He took his objective after heavy loss, but the company next him failed, so he was left with both flanks exposed in an advance position. When the position was taken he could only locate eight men and with these he set about organizing. They took all the German and American rifles and ammunition from the dead and got into shell-holes, and their machine-guns not having come, they beat off the first counter-attack with rifle-fire alone. Their resistance drew scattered men till he had about 35, he being the only officer left. He sent out all day trying to hook up with the next company, but in vain. They started to dig in, which drew a hail of fire, but, as he said, "surprisingly few" were hit. They finally found out how to dig and put the earth in the shell-holes and so organized a position. They gathered all the guns and ammunition, and water, and rations off the dead; and prepared to stay. In the afternoon came a violent counter-attack with tanks. These were put out by artillery, but the infantry came on in waves. Being isolated and his position being unknown, he got little artillery support, but completely repulsed an attack in force, with rifle fire. As he said, they lay in their shell-holes and knocked them over as fast as they came on, each man with several rifles firing as hard as he could till the Germans desisted. We got prisoners who corroborated this; almost the whole counter-attacking force was destroyed. Then at night-fall, his ammunition being nearly gone and no connection being established with the next company, he fell back. I met him going out; his company was on its way safely and he was just as funny as the night we tried him by general court at the class-meeting at Leavenworth.

For training, one day here is worth three in the States. To walk from the front line straight back is an education, for you see in operation all the things you have learned about. In coming up from the rear clear back, where the War has not been nor soldiers billetted, the signs of war are wagon-trains on the main roads, engineer trains on the move, artillery passing along, and refugees always streaming back on high-piled wagons. It seems as though people remain at home till they lose their nerve all at once, because they will flee after months of occupancy, leaving everything in place, not even carrying off clothes. Then gradually you come to towns with soldiers, hospitals in the larger places, more traffic on the roads, motor parks and engineer parks; then towns with more soldiers, gradually increasing till they overflow into all the woods and the roads are choked in the evenings with trucks and wagons hurrying to get up soon after dark. During the day only staff cars and motor-cycles are seen, but late in the day the traffic is immense, run by French military police like railroads, only better, so that the roads do not cross nor traffic mix. Every wood has some sort of park, the towns are full, and the inhabitants are fewer and fewer, also the towns begin to look badly, if not from long-range fire at least from neglect. You begin to see airplane-bomb holes, for the Boche is everhead every night. The field-hospitals are now passed, and you begin to come to ammunition dumps, acres of shells spread over the hills, each pile far enough apart so an explosion would not set off the next pile. This spreads over a great extent, more than you would think possible. Now, if it is day, you are nearing the line of sausages [fixed balloons], which are about a mile apart and form a great fringe on each side of the lines, a guardian airplane in front of every couple. These monsters look like maggots and you can see a dozen stretching along several miles back of the lines, with men watching the enemy's rear through high-powered 'scopes. Along here you pass big guns, long marines at the back, howitzers farther up. These guns run to great size, as big as our coast-defense guns. They shoot up our town every day with birds as big as the disappearing guns at the Presidio and there is a 3.40 hole within a hundred yards of where I sit. It is funny how you get used to things. We used to think 105's were big stuff and now it takes a 210 to make one listen to it.

To continue our trip to the front. From about this point the country begins to look badly. The towns are ruins, completely so within three or four miles, and subject to frequent and violent shelling. The roads are full of holes or patched with broken brick, trees cut

down, and large holes in the fields around; especially is this true around cross-roads and forks, which are particularly unhealthy. One hurries through the towns as fast as possible, or, if taking a company on relief, tries to avoid them altogether. There is no traffic over these roads except a few necessary runners by day, and by night there are troop-wagons and trucks regardless of fire. Gradually one abandons the roads and takes obscure paths across the fields. The grain is high all over this part of France now, so paths are easy to find. Valleys are particularly subject to fire, so one hurries across them and finally reaches the communication trenches, if there are any. In a new sector they are the last improvement to be made, and everything is across the top. In the valleys there is every indication of war, a steep place under a bank is generally a place to scare the timid and to hurry by at night. I lived for four days on the edge of a hill with a small wood on it. I had a dug-out in a little hole under a bank where shells could not drop. It was pretty good except that a team of horses had been hit just in front of the door and it kept us busy burying them as we found the parts. Below, in the valley, was a sight to cure the romantic of any wish for war. Dead horses poisoned the air, the far side and floor of the place were so covered with shell-holes that not a bit of earth remained unturned. Around the battalion-aid station lay a group of dead, wrapped in ponchose, who had died on the way from the front trenches the night before. Wounded have to wait till dark to come out, and those who die meantime are buried at about this point the following night, so that no matter how many the support company buried there were more to do the next night. Equipment taken from them lay all about awaiting salvage, both German and Americans, like the bodies. We gradually got this gathered up, the bodies located and buried, the horses covered and the place a little more shipshape, but you can figure it was no sweet job, as H. E. [high explosive] does not do tidy work. From here to the front lines is a 400 to 1000 or 1500 yards and a C. T. [communication trench] runs out there. However, at night every one goes over the top, carrying parties appear as you go out, hurrying to the rear after bringing ammunition, tools, and wire, or working parties who have been digging and now must hasten at the approach of day, or chow parties with cans of rations, each man with a rifle over his back and moving in a long file out out of the dark into it again. You stumble over trenches, trip on the telephone wires used during the attack a week ago, and fall into shell-holes, but your guide, with the vast experience born of two nights in the sector, picks his way unerringly, and at last you come to a trench rather deeper and more used-looking than those in rear, and you follow it. By now caution is necessary, as the flares which go up frequently are near and as they climb from the ground down you go and wait till they die out. Also, one keeps near the trench so as to pop into it in case of M. G. [machine-gun] fire, which often sweeps the parapet. The men in the trench are fairly invisible except as a flare shows them watching. A grunting fatigue party is deepening the trench in a shallow place, a covering party 50 yards out protecting them from surprise. If you were not hurried along so, you would stop to admire the Boche fireworks: one, two, and five-star green or red rockets, different white rockets, caterpillar strings of light, of immense length—40 or more in a string—a great fountain of sparks placed back of the lines, a brilliant red rocket which hangs in the air and turns to white, and a rocket which shoots two balls of light close together incessantly. The Boche is great on pyrotechnics and when he is nervous it is a great sight. We pride ourselves on how few we shoot, frequently going a whole *tour* without shooting a flare. I think it best not to disclose our position, and also if the men get to looking by means of flares they think they cannot do without and will flare all the time. Some company commanders believe in illumination, but I do not and my company never fire them. We also seldom fire our rifles or automatics, preferring to keep our disposition hid; also firing makes the men nervous and reveals their nervousness to the enemy. The small amount of fire is a test, I think, of a company's self-assurance. All this time, however, we are following the front-line trench till we come at last to the man we are to visit, Withers rushing somewhere at a great rate or Logan very jaunty leaning on a bamboo stick (bought in Nice and appropriate thereto). If the former, the shape in the vicinity is Serg't. Beever, who says, "Good evening, Captain," with a flourish as though to say, "How's the boy, old top?". If it is Logan, Serg't. Jake J. Cooper obscures a lot of the horizon, looking so much like Bairnsfather's 'Old Bill' that it is laughable. The P. Co. [Post Command] is only a cavity under the parapet exactly like the men's funk-holes, but we creep in and hang down a poncho outside so that we can light a candle. A canteen of cognac is produced, if it is cold or you have been shelled on the way in, and a nip is taken—and, believe me, a little hurts no one under the circumstances. Then you go over the sector, which as far as you can see consists of following a trench and then leaving it to plunge across the open toward the German lines, coming at last to a little piece of trench or an organized shell-hole with three men in it for listening post. After visiting several such and the platoon sectors and swapping gossip with the lieutenants, who anxiously inquire on the chances of a relief of the division, you have seen all there is to see, and you start back. Just as you start it seems as though Fritz got a sudden interest in your line of retreat. He suddenly begins firing on the head of the C. T. [communication trench]. You turn aside and start to parallel it, guided by the stars. He lengthens his range and drops 'em along the length of it. Where you pass through the wood they are tearing trees to pieces, so you prudently go round. The crossing of the valley is as bad, so you cross lower down. Then just as you reach the road—Pow! here they come! This, however, is not heavy and by watching you find they are shooting one a minute at a road-fork. You close up as close as you can and then just when one hits, you run forward and pass before the next comes, dropping in the ditch as you hear another

coming. It is strange that as you go up, all the way you have the sense of getting into increased danger, so though one place is the same as another in the first three miles or so, you have a feeling that you are getting close every time you go over a hill; conversely, as soon as you are relieved you feel O. K. when you get 200 yards, though they may be shooting up in great style a mile and a half back, ahead of you.

It is now the close of another day, and this letter has been going for three days, so it must close. We shift again tonight, and as it is about a quarter of nine, I must begin to get ready. As you see, there is much that is unpleasant in the life, but one learns to enjoy his pleasures more keenly. The sun is never so fine as when you creep out of your burrow on a fine calm morning and warm yourself. Off comes the shirt and undershirt, and are inspected, then you lie around and enjoy the air. Also when you get a chance to go back to where your kitchens are, a few miles back, how fine are the wheatfields full of red poppies and cornflowers, and the little woods full of thick grass! Altogether it is very satisfactory, a work for men to do, and though we all kick and crab at injustices done us, mostly imaginary, I suppose, and at the ease in which others sit in Paris and the rear, they will never know the satisfaction, for instance, of examining the airplane photographs of the new trenches you dug, and of pointing out where you drove the Boche out of his positions and incorporated them in your own, to correct the line.

A Flowing Dump

The accompanying illustration represents a dump that is steadily flowing like a plastic mass, although the pieces

CHLORITE-SCHIST DUMP AT PIEDRA, CALIFORNIA

are broken to the usual size of mine-waste. The material consists of chlorite-schist associated with magnesite, coming from the Piedra mine of the Piedra Magnesite Co., in Fresno county, California. The angle of the slope, over which the schist has spread from the end of the tramway at the mine-mouth, is only about 12° from the horizontal. Owing to the anti-friction property of the chlorite-schist it constantly creeps down this extremely flat slope, spreading in the shape of a fan from a width of 20 ft. at the top to 75 ft. at the bottom. The mass flows so rapidly that it is nowhere more than 18 in. thick. The schist disintegrates on exposure to the air, facilitating its movement. Within the mine the schist constitutes the hanging wall of the magnesite deposit. The footwall generally consists of a variety of serpentine, here and there replaced by amphibolite.

ALUMINUM-BRONZE containing iron can be commercially used for die-casting. H. Rix and W. Whitaker found this metal superior to brass (60-40) containing about 2% aluminum, and to manganese brass for the reason that in the case of the last two metals the die becomes rapidly coated with zinc oxide, which spoils the definition of subsequent castings unless removed. The tendency of the metal to form pear-shaped cavities can be eliminated by a study of grating, venting, and the like. Promising results were obtained with alloys containing 7 to 10% aluminum and 1 to 4% iron. One of these alloys is being cast commercially. Twenty-four test-bars of this metal cast in a one-inch chill, and cooled in air, gave the following results when tested: diameter of test-section 0.564 in., yield point 14.7 tons per square inch, ultimate tensile strength 35.5 tons per square inch, elongation on 2 in. 24%, and reduction of area 21.8%. The alloy is sufficiently fluid to fill the die and to give satisfactory castings over a wide range of temperature, but the authors recommend accurate pyrometric control if consistent results are required. The best material for dies was found to be a close-grained cast-iron, as hard as is consistent with good machining properties. No facing or special treatment of the dies is necessary, but the steel plugs are dipped in a graphite wash between casts.—Jour. Inst. Metals.

TIN USED IN THE SILK INDUSTRY. Silk is easily weighted, and because of its costliness there is a temptation to carry the weighting with cheaper materials to a point where the wearing qualities of the silk goods are adversely affected. There are two general methods of weighting; (1) by the use of vegetal or organic matter, and (2) by the use of metallic salts, particularly tetra-chloride of tin. The first increases the weight, but does not materially affect the fibre; the second is apparently not injurious if carefully applied in reasonable amounts, but if used to excess it destroys the silk. Tetra-chloride of tin is obtained by treating scrap-tin with chlorine gas or with hydrochloric acid, the scrap-tin being waste from tin-plate mills and from old tin-cans. It has been estimated that the American silk industry requires annually from 6000 to 7000 drums, of 900 to 1000 lb. each, of tin tetra-chloride, which contains 45.4% metallic tin. The tin salts are fixed on the silk by successive baths and about a third washes off to be recovered and re-sold. One of the largest silk-dyeing companies estimates that the actual metallic tin sold with silk goods in this country amounts to nearly 1000 tons per annum.—U. S. Tariff Information Series No. 3, 1918.

DURANGO, COLORADO

Operations in the Silverton, Red Mountain, Telluride, Ophir, and Rico Districts.

Silverton.—The Iowa Tiger mine and mill is working steadily on three shifts, shipping a good deal of concentrate.

The Telescope Mountain Mining Co., consisting of Colorado Springs men, has opened a promising vein at Chattanooga, and has shipped a car of ore. There are several carloads ready.

The Mears and Wilfley flotation mill has resumed treating tailing from Silver Lake basin, and has shipped a car of concentrate.

The Anvil Leasing Co., managed by E. Johnson, has added the Diamond, Topaz, and Sapphire lodes to its holdings. All of them adjoin the Emerald lode on which the company is leasing. All contain copper.

A Kansas City, Missouri, company has been formed to

PART OF THE SAN JUAN REGION, COLORADO.

operate the Little Nation mine, under the name of the Little Nation Mining Co. The new owners have shipped a car of ore, and expect to ship steadily.

The Gold King Extension Mining Co. is composed of leading Colorado men, backed by Boston people. W. Z. Kinney is manager. The whole property is well tunneled, and the workings are in excellent condition. The ore contains copper, iron, gold, and silver. Rich pockets of gold ore are sometimes found.

With the opening of the Gladstone branch of the Silverton Northern railroad shippers are loading cars. The Lark at Henrietta, and Venus at Gladstone have resumed shipments.

Red Mountain.—The Red Mountain branch of the Silverton railway is open and all roads are passable. Heavy rains caused some delay.

The Red Mountain Mines company, managed by George Collins, is developing a large body of pyrite near the Joker tunnel. The Yankee Girl is being re-opened by the Red Mountain company. There is a large quantity of water in the lower workings where the richer silver orebodies were worked, but it is expected that they will be pumped dry in the near future.

The Kapegi Leasing Co. will again work the Congress mine, and is now shipping at the rate of five cars per week.

The St. Paul Mining & Reduction Co. has leased its holdings at Summit to Schafer & Ross for the current year.

Telluride.—The Lewis Mining & Leasing Co., operating at Smuggler Union properties, has started shipments. The mill is concentrating 25 cars daily, and with the addition of another unit will increase the capacity to 60 cars. Five tons of concentrate are loaded each day.

Ophir.—Despite climatic handicaps and the recent fire, the Alta mines, of the Belmont Wagner company, are ready to ship. The new mill is almost completed. Construction was carried on during the entire winter, although the snow surrounded the workings to a depth of 10 ft., and the labor shortage was acute. The tramways have been restored since the fire, and will continue carriage of ore from the mine to mill, until the Black Hawk tunnel is completed.

J. M. Belisle has secured contracts for supplying metals to munition works. He has a number of good manganese, molybdenum, uranium, and carnotite claims in Paradox valley, but has a difficult problem as the claims are 75 miles from rail.

Rico.—The Rico Argentine is not shipping as heavily owing to shortage of labor, and other factors.

The Engel claims on Expectation peak are the scene of great activity. A car of ore has been shipped, the forerunner of a steady output.

CRIPPLE CREEK, COLORADO

New Developments.—Lease Notes.—Water From Roosevelt Tunnel.

The lease on the property of the Rose Nicol company on Battle mountain, adjoining the Portland estate on the north-east, has been transferred by the Camp Bird M. L. & P. Co. to the Reva company. Ore has been opened on the tunnel-level of the Rose Nicol, while veins are also being developed from three levels of the main shaft.

The Modoc Consolidated, operating through the Last Dollar shaft, on which the company holds a bond and lease, is shipping ore from this Bull Hill property. Plans are being prepared for a large new ore-house.

It has been officially announced by the Portland company that a shoot 4 ft. wide, averaging $30 per ton, has been cut on the Roosevelt tunnel-level in Portland ground, at a depth of 2131 ft. This ore pitches south into an area not considered especially productive. A second discovery has also been made on No. 19 level of No. 2 Portland shaft. This also pitches south.

A small sacked lot of ore from the Ella W. on Tenderfoot hill, sampled by the Eagle Ore Co. last week for M. Johnson, was settled at $63 per ton. This was mined at a depth of 35 feet.

The flow from the Roosevelt tunnel last week was 3350 gallons per minute.

Operations in the main heading of the Roosevelt drainage-tunnel were not extended during July, but the Portland cross-cut was advanced 210 ft., and the heading of the lateral is now 1126 ft. from the main tunnel, at a point about 1000 ft. from the shaft. A vein, 4 ft. wide, assaying $30 per ton, has been cut by this work on the tunnel-level at a depth of 2131 ft. below the collar of the No. 2 Portland shaft. The Cresson drift was advanced 120 ft., and its heading is now 1301 ft. from the starting point in the tunnel. In addition a station was cut 10 by 12 ft. and a cross-cut driven 18 ft. from the station, a total of 186 ft. in Cresson territory.

The Cresson company's profit in June was $130,927. The usual monthly dividend of 10c. per share, equal to $122,000, was paid on August 9. This makes $6,661,162 to date. Cash in banks totals $1,038,551, plus 30 cars of ore valued at $25,000. Ore-reserves on July 1 were estimated as worth $3,128,956, an increase of $360,231 since the last measurement. The new ore-shoots on No. 7 and 10 levels have been developed sufficiently to allow of their being included.

The Portland company is to consolidate its Victor and Independence mills. This will result in more economy, and relieve the labor shortage.

MAYER, ARIZONA

Diamond-Drill Practice in the District.

Interesting results are reported from diamond-drilling in the Blue Bell and Binghampton mines in this district. The prevailing schist formation, in which the ore occurs, is vertical or nearly so. The ore is found in lenses which conform to the angle of the formation. In the flat porphyry deposits of copper, prospecting with drills is done by vertical holes, while in the schist-zone in this district the holes are all bored horizontally, cutting the formation east and west. This work is being done on a deep level of the mine. The Arizona Binghampton company leads in the amount of diamond-drilling done so far here. Cannon Brothers Exploration Co., formerly of Butte, are doing the work. F. G. Cannon manages the work at the Binghampton mine, and a brother has a number of contracts in the Oatman district.

A Government permit is now necessary before diamonds can be purchased. A buyer must satisfy the Government that the stones are to be used for drilling in the United States. Since a great deal depends upon the quality of the stones, Cannon Brothers usually make their purchases of diamonds from lots sent from the East to a bank where the selections are made. Formerly, black diamonds weighing 1¼ carats were used in the bit, six to the set. It has been found that diamond 'chips', about 12 to the set, do better work. The diamonds in a drill-set are worth $1000, the cost of the black diamonds being about the same as the brilliant. A bit will drill from 40 to 60 ft. without needing re-setting. The cost per foot for diamond wear is 50 cents. The cost per foot of drilling is from $2.50 to $3. It is necessary to employ two men, the runner and the helper. The runner receives $6 per day and must be experienced.

The apparatus machine used in the Binghampton is known as the Sullivan Type E, a small single-cylinder machine using 1¼-in. bit. The core is ⅞ in. diameter and 5 ft. long. The holes in both the Blue Bell and the Binghampton are from 100 to 200 ft. long. They are not spaced at any regular distance, but are usually around 100 to 150 ft. apart. One 8-hour shift can drill 15 ft. As much air is used by the diamond-drill as is required for two Leyners and as much water as for one Leyner.

A total of 7000 ft. has been drilled in 45 holes at the Binghampton. The company proposes to do twice as much drilling in the next few months. The Blue Bell work amounts to 23 holes, from 100 to 200 ft. long and 120 ft. apart. Most of the drilling in the Blue Bell has been done on the 800-ft. level, while in the Binghampton, several levels have been prospected. The average core recovery is 100% in the quartz and ore formation, and about 85% in schist.

The main object of diamond-drilling by this method in the Mayer district is to discover orebodies that are supposed to exist in the mineralized zone. The cost is one-quarter that of driving drifts. After a level has been drilled, a definite plan of development can be carried out by drifts. Recently, an orebody of considerable importance was found by diamond-drilling on the 400-ft. level of the Binghampton, only 30 ft. from old workings. In the Blue Bell, a lens of ore was picked up on the 800-ft. level in virgin ground far to the north of the developed orebodies. In both mines, a great deal of time and money has been saved by this method of prospecting.

Diamond-drilling in this district is looked upon as another great improvement over past methods. The ore—both the copper and the more complex gold, silver, lead, and copper ores—is especially amenable to oil flotation. The smelter at Humboldt is well equipped to handle the custom business in concentrates from the flotation mills. The Mayer Ore Purchasing Co. is operating its custom mill now, offering a market for ore in small or large quantities. What the Mayer district needs most is more capital to develop the many excellent prospects.

The report of the Consolidated Arizona Smelting Co. for 1917 may be summarized as follows:

Property: mines at Mayer and Middleton, and concentrating plant and smelter at Humboldt, Arizona.

Operating Officials: G. M. Colvocoresses, general manager; W. V. De Camp, superintendent.

Financial Statement: value of metals produced was $5,606,641, of which $881,816 was profit. In 1916 this was $859,015, and in 1915, $194,943. Reserve for working capital, $400,000, depreciation, $264,973; taxes, $88,790; dividends, etc., reduce the profit to $29,728. Balance from 1916 was $390,204, and that to 1918, $169,632. Current assets total $982,411, against $455,054 liabilities. All of the mortgage bonds were retired in 1917.

Dividends: two absorbed $166,300.

Development: at the Blue Bell mine the main shaft was sunk from 1000 to 1200-ft. depth. This cost $58.43 per foot. Also 3461 ft., costing $13.51 per foot, mainly on No. 8, 9, 10, and 12 levels. A new 'blind' orebody was found above 700 ft. Results in 1918 should be much better than in 1917. The mine is equal to producing 400 tons daily.

At the De Soto mine, 532 ft. of work cost $11.20 per foot. Results were not encouraging, and the future depends on work done in 1918.

Reserves are estimated as follows:

Mine	Tons	Copper, %	Gold and silver
Blue Bell	536,800	3.1	$2.00
De Soto	66,200	3.0	2.00

Concentrator: this plant dressed 106,226 tons of ore, 61,689 tons from the Blue Bell, 39,330 tons from the De Soto, and 5207 tons of old tailing. The average copper content was 2.976%, and gold and silver $2.19 per ton. Extraction was 90.4% copper, 74.95% gold, and 74.22% silver. Milling troubles are not solved yet, especially in the grinding department, which is being improved.

Smelter: these works are considerably improved. Seven large and 55 small mines supplied custom ore and concentrate. Including 33,804 tons of concentrate from the company's mill, the furnaces reduced 138,781 tons of charge, extracting 87.94% gold, 95.02% silver, and 90.70% copper.

Production: 8,213,611 lb. copper, 6620 oz. gold, and 169,778 oz. silver from company ore; and 11,537,427 lb., 2865 oz., and 81,892 oz. from custom ore.

Costs: on a per ton basis these were:

Mining, ore delivered at smelter	$3.290
Milling	1.776

On a per pound basis they were 14.98c. for company ore.

ALASKA

Anchorage.—A number of important discoveries have been made during the present season, and the district has been unusually active.

Control of the Gold Card mine in the Willow Creek district has been purchased by Frank Bartholf of Billings, Montana, John Smith of Los Angeles, California, and J. B. Swan of Henrietta, Oklahoma. The new owners will develop the mine during the coming year and erect a mill next summer. They will also develop hydro-electric power for their own use and supply other mills in the district. William Martin has a lease on the property at present, and is milling high-grade ore at the mill of the Alaska Free Gold Mining Co. The vein is from 10 to 14 ft. wide.

W. F. Rock of Denver has purchased an interest in the Miller Bartholf property, and is making arrangements to erect a mill.

Juneau.—The report of the Territorial mining inspector—William Maloney—for 1917, is just to hand. The interesting points show the cost of supplies in many instances to have risen 200 per cent in three years, the stream tin output was 232 tons (about 70% metal), antimony mining continued on a small scale, tungsten mining promises to contribute a good yield, coal was mined to the amount of 61,000 tons, a mine-experiment station was established at Fairbanks, provision has been made to start a mining and metaliurgical school, and generally there was ample labor throughout the Territory. The principal lode and placer operations are detailed, also accidents in the mines. A list is given of the operating dredges, lode, and placer companies.

Kennecott.—Copper production of the Kennecott company in July was 5,090,000 lb., compared with 10,750,000 lb. in 1916.

Sitka.—Nickel ore has been reported at three localities in Alaska—on the west coast of Chichagof island, near Copper river, and on Knight island, Prince William sound. The deposits on Chichagof island and near Copper river were examined in the summer of 1917 by R. M. Overbeck, of the U. S. Geological Survey. A brief statement of the results of that examination follows: The nickel deposits of Chichagof island are situated on the west coast of the island, 3 miles north-west of Pinta bay, or 65 miles north-west of Sitka. Development consisted in 1917 of a 180-ft. shaft, with 155 ft. of drifts at the 80 and 180-ft. levels, and of several prospect holes. Neither the outcrops nor the underground workings are of sufficient extent to permit any reliable estimate of the amount of ore that may be present at this locality. Orebodies of this kind are generally irregular. The amount of ore shown in the present workings therefore does not justify large investments in facilities for mining, ore treatment, or shipping. The amount of ore available and the geologic conditions at the locality do, however, encourage the hope that workable orebodies will be developed, and justify the expenditure of a moderate amount of money in blocking out the known orebody and in the search for other orebodies. The Copper River nickel locality is situated near the headwaters of Canyon creek, 13 miles east of Copper river, opposite Mile 121 on the Copper River & Northwestern railroad, at an altitude of more than 4000 ft. Mining claims have been located on the outcrops of basic dikes which cut the schist. Only a little underground work has been done. Pyrrhotite and chalcopyrite are indentified at a few places, but there is no evidence of extensive mineralization. The amount of ore cannot be estimated on account of the small amount of underground work and the fact that at one locality, at least, the orebody has been faulted. A selected specimen of ore contains 7.23% Ni and a trace of cobalt, but most of the known ore is believed to be of much lower grade. A nickel deposit is said to have been discovered on Knight island, Prince William sound. It is reported that this deposit was being prospected with a diamond-drill in the summer of 1917, but the locality has not been visited by any member of the Geological Survey, and no authentic information is available.

Valdez.—The Columbia Red Metal Copper Co., operating between Long and Cedar bays, has erected a sawmill. A monorail tram is being built from the beach to the mine. High-grade ore is to be shipped, and a mill is to be erected later on. C. C. Elwood is manager.

The Free Gold Mining Co., in the Port Wells district, has opened rich ore at a contact of granite and slate. A 5-stamp mill is being erected.

ARIZONA

Bisbee.—The Copper Queen Branch of Phelps Dodge, and the Calumet & Arizona company, have announced a new housing plan for Warren. It provides that the companies will build homes for their employees on plans provided either by the employees or by the company, and will sell them to employees on terms of rent, with interest on deferred payments at only 6%. It has not been the policy of the companies operating in the Warren district to build houses for rent but rather to provide means whereby employees may own their own homes, and acquire them without trouble. In the past this has been provided by the Cochise Building & Loan Association, which has a liberal policy and is responsible for the building of over 300 houses at Warren, the residence area of the Bisbee-Warren district. The new plan provides for loans to employees only, and does not necessitate that they have a large amount of money to make the preliminary investment and the purchase of the lot.

Clifton.—The fire in the Coronado mine of the Arizona Copper Co. still burns. The area was bulkheaded, but one of the bulkheads was blown-out by gas recently, killing a shift-boss and two men.

Globe.—The Iron Cap company pays a dividend of 25c. per common share on September 2.

The Superior & Boston Copper Co. has made an assessment of 50c. per share, on 297,827 shares. The 1000-ft. level of the Telfair claim is reported to show an improvement.

Prescott.—The Senator-Groom Creek district, 6 to 15 miles south of Prescott, is worthy of investigation, according to 'Yavapai' of July. Many of the gold mines have been idle for years. The Midnight Test was re-opened in 1916, but has been closed again. Other idle properties of merit are the Home Run, Empire, Gold Basin, Monte Cristo,

Silver King, Sunnyside, Gold Warrior, Ratcliffe, Dunkirk, Lookout, Bodie, Crook, Mount Union, and others. Most of these have mining and milling plants of some kind, and are said to have good possibilities. One of the troubles is the complex character of the ore. The Big Pine is treating 100 tons daily. Some work is being done on the Senator, Tillie Starbuck, Venezia, Blackstone, and others.

Ray.—The Ray Hercules mill is expected to be at work this month.

Ray Consolidated is sinking ten 100-ft. wells in the bed of the Gila river to add to its mill water-supply at Hayden. Air-lifts will be used for pumping.

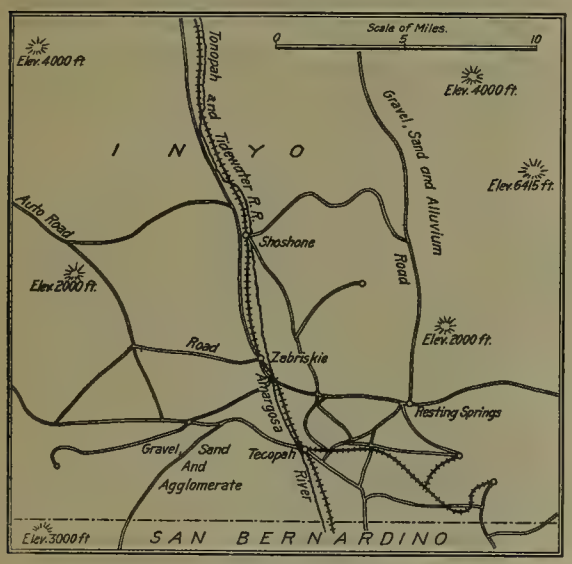
CALIFORNIA

Death Valley.—According to W. B. Hitchman, of the Tonopah & Tidewater Railroad, three of the largest talc mines in this country are shipping ore from Acme and Riggs. A new station named Talc has been opened.

Lamoine.—The Copper King mine in Trinity county has turned out to be a fairly good chrome property. Twenty-five tons daily is being hauled to Gibson, the next station above Lamoine. G. R. Bland is the managing owner.

Talus.—The California Sulphur Co. is to erect two retorts here, capable of distilling 30 tons of ore daily from its deposits near Coso Springs, in Inyo county. O. B. Bacham of Los Angeles is vice-president.

Zabriskie.—In December 1917 the Secretary of the Interior was informed that large deposits of nitrate of soda



THE NITRATE DEPOSITS DESCRIBED IN ACCOMPANYING REPORT ARE IN THIS DISTRICT.

had been discovered in Amargosa valley, in Inyo county. As these deposits were said to be large and rich enough to relieve the United States of the necessity of importing from Chile the sodium nitrate required for making munitions and fertilizers, and as the need of using all available shipping for other war work was urgent, the Secretary at once called upon the Geological Survey to examine the deposits. Four geologists were accordingly sent from Washington to make the examination, and on reaching California the party was increased by the addition of another geologist and 10 other men, most of them experienced miners. The deposit was said to be in the valley of Amargosa river, 2½ miles west of Tecopa and 3½ miles south-west of Zabriskie, near the Tonopah & Tidewater railroad. The Survey had already been systematically exploring other well-known nitrate deposits along Amargosa river above Death valley, among them those called the Upper canyon, Lower canyon, and Saratoga deposits. The results of these explorations indicated that the sodium nitrate in these deposits was small, but the reports as to their character and extent were conflicting, and it was therefore decided to determine conclusively their value.

The Amargosa district includes 11 so-called nitrate fields, all in or near the valley of Amargosa river—the Zabriskie field, in which the newly-found deposit was reported to lie, and the Resting Springs, Tule Springs, Upper Canyon, Lower Canyon (Sperry), Salt Springs, Saratoga, Round Mountain, Valley, Confidence, and Owl Springs fields. The exploring party eliminated the deposits in the Salt Springs, Tule Springs, and Resting Springs as probable sources of nitrate by preliminary tests, and sampled in some detail the deposits in the Saratoga, Confidence, Zabriskie, Upper Canyon, and Lower Canyon fields. They did not study the remaining fields in detail, for reconnaissance examinations and tests had indicated that the deposits in them were not different from those in the fields examined. The examination covered from December 26, 1917, to April 4, 1918 Numerous preliminary chemical tests were made in each field to determine favorable places for exploration. Scores of trenches were then dug down to and into the bedrock to determine whether any of the beds were especially rich in nitrate. Then many hundreds of pits were dug, each deep enough to penetrate the upper part of the bedrock. Samples were taken systematically from the trenches and pits, each sample was weighed, and most of the samples were ground, mixed, and divided to form representative samples weighing a pound each. Preliminary chemical tests of more than a thousand samples showed that many of the deposits were of no commercial value.

The results of the work may be briefly summarized as follows: In all, 78 trenches were dug, which had a total length of 3700 ft. and an average depth of 2 ft. 11 in.; 959 pits were dug to an average depth of 1 ft. 7 in.; 1085 samples were taken, from which 930 analyses were made. In the so-called Upper Canyon field, at Acme siding, 98 acres is estimated to contain 1480 short tons of sodium nitrate, but an overburden of about 100,000 tons would have to be removed in order to extract the caliche containing this nitrate. In the so-called Lower Canyon field 70 acres is estimated to contain 510 tons of sodium nitrate, the recovery of which would involve the removal of an overburden of about 50,000 tons. These two tracts are the largest and best of the ground examined, and, taken together, include 168 acres, which, if workable, might yield 1980 short tons of sodium nitrate, the recovery of which would involve the removal of 150,000 tons of overburden. The results of examinations at other places do not justify estimates of tonnage of nitrate.

The Survey's explorations have led to the following conclusions: (1) The nitrate in the Amargosa district occurs in a blanket of so-called 'caliche' about 5 in. in average thickness, lying about 9 in. below the surface of the ground. The nitrate is accompanied by other salts, chiefly sodium chloride. (2) The soil above and the bedrock below the deposits contain insignificant amounts of nitrate. (3) The high dip and the great thickness of the strata covered by the prospecting make it improbable that deeper beds of nitrate occur in this region. (4) The caliche in general contains an average of less than 2.5% of sodium nitrate, the areal distribution of which is uneven. (5) The Zabriskie field, in which the newly-found deposit was reported to lie, contains no commercially valuable nitrate. (6) The Upper Canyon and Lower Canyon fields, the most promising in the Amargosa district, together contain, according to careful estimate, about 168 acres of nitre-bearing deposits, which, if worked regardless of cost, might produce about

1980 short tons of refined nitrate. (7) The quantity of nitrate available in the Amargosa district is so small and the cost of production would be so great that the district as a whole cannot be regarded as a source of commercial nitrate. (8) No further work on the areas already examined is justified, except, perhaps, as purely scientific research. (9) The occurrence of caliche nitrate deposits in the Amargosa district, rather than the usual cave or disseminated deposits, makes it seem possible, though improbable, that really valuable deposits of nitrate may occur elsewhere in the same general region. (10) Prospecting should be continued until all similar deposits in other districts have been tested sufficiently to determine their value.

COLORADO

Central City.—On the 700-ft. level of the Gilpin-Eureka mine there is 10 ft. of good concentrating ore. G. W. Platt is to recommend erection of a flotation plant. Present recoveries are 65%. The amalgamating plates are to be altered. The main shaft is to be deepened 200 feet.

Jamestown.—Four mills are now available here for concentrating the low-grade fluorspar rock.

Leadville.—At the Jason property on Poverty flats, J. A. Clarke is to re-open and equip the old Neptune shaft. From this it will be possible to exploit the manganese ore being worked from the Jason shaft. The daily output is 40 tons of 27 to 35% ore.

The Doty Manganese Co. is being financed in order to operate on a larger scale.

The Hibschle mine is producing some rich lead ore, also some manganese-silver ore.

Montrose.—The Radium Ore Sampling Co. announces that it has completed a $12,000 rare-ore custom-sampler here, and that it is prepared to sample all kinds of rare and precious ores and concentrates. Particular attention has been given to making accurate moisture determinations, and to the collection, saving, and sampling of valuable carnotite dust and other ores. This company is composed of 25 of the leading business-men of Montrose. The company are not assayers, purchasers, brokers, or in any way dealers in ores or their products.

Silverton.—Ore and concentrate shipments from this district in July totaled 240 carloads.

IDAHO

Kellogg.—The Caledonia Mining Co. made a profit of $368,068 during the first half of 1918. The excess of assets over liabilities is $616,980. Dividends paid during the period were $468,900. The output was 10,511 tons of ore assaying 16.26% lead, 37.01 oz. silver, and 0.3% copper. Mining cost $7.40 per ton. The president, Stanly A. Easton, states that the present output will not continue more than three or four months. Present dividends are to be maintained, partly from earnings and partly from the large surplus.

Mullan.—The Federal M. & S. Co. made a profit of $90,178 in June, compared with $276,533 in June of last year.

Orogrande.—The Orogrande Gold Mining Co.'s trial mill runs were 1700 tons of $2, 2697 tons of $2.03, and 2939 tons of $1.93 gold ore. This was mined by open-cut methods. By selective mining an average of $3 or $4 per ton could be secured. A profit of about $1 per ton is expected from $2, when milling 400 tons per day. Amalgamation is in use. William Hogan is superintendent and H. E. Hewitt, metallurgist.

Sandpoint.—The Falls Creek mine, three miles east of Pend Oreille lake, has started its 50-ton mill. It cost $50,000 to put the property on a producing basis.

Wallace.—Tamarack & Custer pays 6c. per share on August 27. This is equal to $106,575.

MICHIGAN

Houghton.—Owing to the increase in freight rates, applying to ore as well as to other commodities, the Franklin mine has been closed.

The Ahmeek company has re-opened No. 3 shaft, which has been closed for a month on account of the fire. No. 4 will be kept closed for some time yet.

Wolverine reports as follows for the year ended June 30, 1918, compared with previous years:

	1917-'18	1916-'17	1915-'16	1914-'15
Ore dressed, tons	303,498	353,845	388,898	391,614
Yield per ton, pounds	15.185	16.600	17.070	18.230
Total copper, pounds	4,608,865	5,856,889	6,541,492	7,250,866
Cost per ton	$1.914	$1.630	$1.390	$1.200
Cost per pound, cents	18.927	11.540	9.430	8.430

Wolverine made a profit of $241,920 during the year ended June 30, 1918, compared with $1,026,405 in 1917, $735,218 in 1916, and $318,201 in 1915.

Copper Range pays $1.50 per share on September 14. This makes $4.50 for the current year.

MISSOURI

Joplin.—Production of the region last week was 7627 tons of blende, 224 tons of calamine, and 934 tons of lead. These averaged $51, $34, and $100 per ton, respectively. The value was $495,908, to which Missouri contributed $100,509.

MONTANA

Butte.—During July, Butte & Superior produced concentrate containing 5750 tons of zinc, and 225,000 oz. of silver. The recovery was 90%.

Helena.—A new shaft at the Scratch Gravel mine is reported to have cut a vein of rich gold ore at a depth of 21 ft. Three carloads are valued at $18,000. Water is hampering sinking operations. T. B. Miller is resident director.

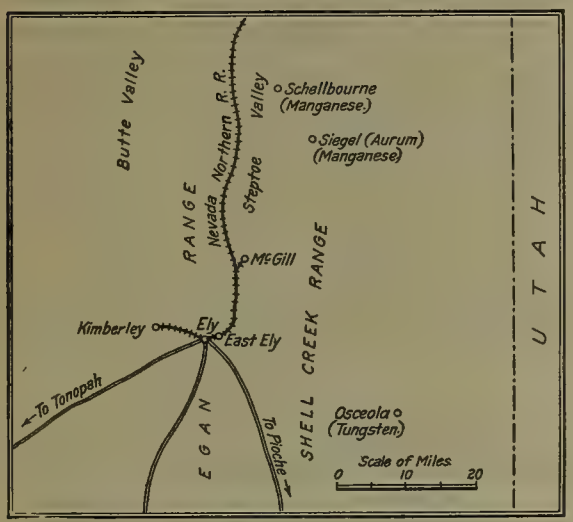
NEVADA

Belmont.—The Monitor Belmont mine, flooded since 1878, has been purchased by the Nevada Wonder Mining Co. The workings will be unwatered when new equipment is erected. Jay A. Carpenter will be in direct charge of the work.

Ely.—Consolidated Coppermines Co. produced 7,702,470 lb. of copper, 150,647 lb. of lead, 29,188 lb. of zinc, 8917 oz. of silver, and 137 tons of manganese during the first half of 1918. Churn-drilling has been suspended.

An examination of the deposits of manganese ore in White Pine county, in the Ely (or Robinson) district and the Siegel (or Schellbourne or Aurum) district, was made by J. T. Pardee, of the U. S. Geological Survey, early in June of this year. His reconnaissance covered an area 50 miles long from north and south and 20 miles wide, comprising part of Steptoe valley and the mountains that border it on the east and west. The Siegel district lies in a high and rugged area. The manganese ore extends from the surface to a depth of 50 ft. or more. Practically all the deposits occur in limestone and are associated with bodies of jaspery quartz. The manganese minerals have replaced both the wall-rock and the quartz. The orebodies are irregular pipes, pickets, and lenses, which range from a few feet to 70 ft.. or more in length, and from a few inches to 10 or 20 ft. in width. Several of the larger bodies contain from 500 to 1000 tons or more. Water-level has been reached only in the Siegel mine, where it stands 200 ft. below the surface. The bulk of the ore is composed of the softer manganese oxides, pyrolusite being predominant in some mines and wad in others. The wad is generally rather compact and tough and can be whittled like wax. Philomelane and manganite, though rather widespread, occur in subordinate amount. Fairly large masses of a very hard compact black manganese oxide, tentatively regarded as braunite, are found in the Bowen and Holmquist mine. The ore below water-level in the Siegel mine is composed of rhodonite, rhodo-

chrosite, and alabanite. Jaspery quartz, calcite, and iron oxides are generally associated with the manganese minerals. In the Siegel mine, cerusite and massicot were observed above water-level and galena and pyrite below. Most of the ores contain some silver. The ore mined contains from 36 to 45% manganese, 3 to 16% silica, 3 to 5% iron, a moderate amount of lime, and very little phosphorus. Parts of the orebodies not now mined or rejected in sorting ore for shipment contains more than 16% silica. Ore containing 25 to 30% of manganese and 15% or more of iron occurs in several places. A total output of 2108 short tons of 40% manganese ore was produced by seven operators up to June 1, 1918, the first shipments having been made late in 1917. In addition, 1200 tons was produced by the Siegel mine from 1902 to 1908, but this ore, though high in manganese, was smelted for silver and lead, the manganese being lost in the slag. About 550 tons per month is now being shipped from the Ely and Nevada districts. Additional



THE MANGANESE DEPOSITS OF WHITE PINE COUNTY ARE SHOWN IN THIS SKETCH.

equipment now being installed by one of the operators is expected to increase the production by 100 tons per month, and if the Siegel mine becomes active it will produce an additional 250 tons, so that the total monthly output will be 900 tons. Most of the orebodies are near the surface, and can be mined by open pits or shallow shafts and tunnels. Water usually has to be hauled and mine timber, machinery, and general supplies are said to be rather expensive and difficult to obtain. Wages are $5 per day and miners are said to be fairly numerous and to prefer employment with the manganese or other small mines rather than with larger corporations. Board is $1.25 per day. The cost of hauling the ore from the Ely district to the railway, a distance of 2 or 3 miles, is about $2 per ton. The cost of hauling by motor-truck from the Nevada district to East Ely, a distance of 10 miles, is about $4. The distance from the Siegel district to the railroad is 30 miles by one and 40 miles by the other of the two most available roads. Estimates as to the probable cost of transportation from this district to the railroads range from $6 to $10 per ton. The high-grade manganese ore (40% manganese and low silica) now in sight is estimated at 5450 tons; the ore containing 15 to 40% manganese and high silica, at 5000 to 12,000 tons; the ore containing 15 to 40% manganese and high iron, at 1650 to 4000 tons; and the sulphide and silicate ore carrying 20 to 35% manganese and 20 to 37% silica at 1000 to 3000 tons.

Eureka.—According to the Eureka 'Sentinel' the Eureka-Nevada railway has been asked to haul 900 tons of ore monthly from Mineral station to Palisade. The request was made by the U. S. Smelting Co., the ore to be supplied from the mines at Mineral Hill for the company's smelter at Kennett, California. The railway is unable to handle this tonnage with its present equipment, but has offered to take over 600 tons.

Tonopah.—During the first half of 1918 the Jim Butler company received $294,354 for ore shipped to the Belmont mill, $169,528 being profit. Cash resources on June 30 totaled $266,266, including $100,000 for Liberty Bonds. The interest of this company in the Belmont Shawmut (California) and Belmont Wagner (Colorado) companies is $328,036.

NEW JERSEY

Franklin Furnace.—The New Jersey Zinc Co. reports that in the second quarter of 1918 its net income was $3,697,644, of which $2,800,000 was paid in dividends. The profit is almost similar, but dividends are double those of the March quarter.

NEW MEXICO

Magdalena.—The Calumet New Mexico Mining Co. has under construction a new concentrating plant to dress its complex lead-zinc-gold-silver-copper ores. This will be a modern mill in every respect, so arranged that the flow-sheet can be changed in many ways to ensure the best treatment of the different ores. Equipment includes a Blake crusher, rolls, ball-mill, impact-screens, sand and slime tables, and flotation apparatus. The entire plant was purchased from the Colorado Iron Works Co. The capacity of the first unit will be 50 to 100 tons per 24 hours, depending on treatment necessary. Excavation and foundation are finished, and a good part of the frame-work is already erected. The start of milling will depend on delivery of machinery.

The Mammoth Mining & Milling Co. has its mill at Pinos Altos ready for the belts. Its operations are based on a gold-silver-copper ore of $16 value.

Mogollon.—The Socorro M. & M. Co. started its new 250-ton mill at full capacity on August 1. The new arrangement has reduced power consumption by 75 hp. on the same tonnage; also employs several men less per shift.

A new vein carrying high-grade silver-gold-copper ore was recently cut in the Johnson mine of the Socorro company. The vein is 4 to 5 ft. wide, and has been opened over 60 ft. Connections are being made to cut this from No. 1 shaft.

The Oaks company is sinking the Central shaft on the Deep Down mine.

OKLAHOMA

Picher.—Production of the district last week was 6777 tons of blende and 755 tons of lead, valued at $373,019.

OREGON

Baker.—The Highland mine, 14 miles from Haines, has been sold by F. R. Mellis of Baker to Flanagan, Quinn & Darcy of Tacoma, Washington, representing the National Mines Co. John Thomas of Portland made the examination and will act as supervising engineer. The property has been worked intermittently since 1891. From June 1912 to April 1914 the new mill yielded 4750 tons of silver-lead-zinc concentrate, which sold for $226,205. Financial troubles led to a suspension of work in May 1914. A sheriff's sale was held in August 1915. The mine has yielded $305,000 to date. A flotation plant is to be added to the mill.

UTAH

Alta.—The South Hecla company shipped over 1500 tons of ore during July, while lessees mined 400 tons. This was valued at $20 per ton. About 75% is copper-silver sulphide, the remainder silver-lead carbonate.

At the Albion, water has retarded progress in the tunnel.

The Alta-Michigan shipped 250 tons of $15 copper-silver ore, and South Hecla Extension 140 tons.

Bingham.—It is reported that the Utah Consolidated has purchased the Yampa mine, part of which is in dispute between this company and the owners of the Yampa.

Gold Hill.—Wages for miners in the Deep Creek district are $5 for miners, timber-men, and engine-men, $5.50 for shaft-men and blacksmiths, $4.75 for shovelers, and $4.75 for teamsters. Board costs $1.25 per day.

The daily tram from Gold Hill and Wendover may be resumed, according to the 'Gold Hill Standard.'

The Western Utah Copper Co. is to equip its Yellowhammer mine at an early date.

The Western Utah Extension is doing considerable work in its Mogul and Helmet mine.

Lessees at several claims are reported to be shipping good ore.

Indications at 336 ft. in the Pole Star are encouraging.

Park City.—The American Flag Mining Co. has debts totaling $211,750, and is in the hands of a receiver.

Tintic.—Miners in the new shaft of the Chief Consolidated at Eureka have stopped work until they get $7 per shift. The contractor, Walter Fitch, Jr., was paying $6.50, which was 75c. more than the shaft wage would actually be if 50c. was added to the regular miner's wage of $5.25. When the men quit at the new shaft the contractor promptly replaced them with other miners. Work was progressing satisfactorily when the matter was taken up at a meeting of the Tintic District Miners Union, which passed a resolution fixing the daily wage for shaft work in the Tintic district at $7, which is $1.75 more per day than the regular wages paid miners in Utah districts. Following this action of the Union the contractor stopped sinking, and it is quite evident that an effort to enforce this new scale will result in the suspension of all shaft work in this district, as there is not a mining company or a contractor who will pay such wages.

WASHINGTON

Valley.—The Northwest Magnesite Co. produced 4000 tons of calcined magnesite during July. Four kilns are at work, and two more are being built. A 250-hp. oil engine and generator—second-hand—are being erected. Roy Bishop is manager.

MEXICO

Mexico City.—A Consular Report dated July 23 states that Circular No. 6, issued by the Department of Industry, Commerce, and Labor, under date of July 6, relative to permits which in future will be granted for the sinking of oil-wells, provides that inasmuch as many persons and companies to whom permits have been issued for sinking oil-wells have not begun work thereon or have not finished drilling within a reasonable length of time, it has been decided that in future such permits will be considered as subject to cancellation in case work has not been started within six months from the date of the provisional permit granted by the respective agency, and in case work has not been completed within one year from the same date. A period of 90 days is stipulated within which to re-validate any permits that may come under either of the two cases described, this period to begin from the date of the circular. Any permits that may be canceled for any of the reasons stated may be re-validated upon application to the respective agency, which will establish the conditions under which such permits may be renewed.

Mazatlan.—According to J. M. Beach, formerly of Nevada, just returned to San Francisco from a trip along the west coast of Mexico, where he examined several properties for Americans, there are practically no mining operations going on there now. One reason for this is that there is no medium of exchange.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. This information is interesting to our readers.

C. W. Hosmer has joined the Army and is in France.

C. C. Larson, of Minden, Nevada, is at the Stewart hotel.

Lawrence Addicks has returned from Burma to New York.

Bond Coleman has gone from Ojuela, Mexico, to El Paso, Texas.

John F. Cowan, from Utah, was in San Francisco on August 19.

William E. Defty, of Phoenix, Arizona, is at the St. Francis hotel.

S. W. Scarfe, of Nevada City, California, is at the Whitcomb hotel.

Daniel C. Jackling has returned to San Francisco from Washington.

Algernon Del Mar has returned to Los Angeles from Nelson, Nevada.

R. R. Goodrich has gone to Moscow, Idaho, from Anaconda, Montana.

J. A. Willey has returned to the United States from Nicaragua, Central America.

Myron A. Folsom, who has been at Washington, has returned to San Francisco.

J. W. Sherwin, superintendent of the West End mine, Tonopah, was here last week.

J. W. Doty, general manager for the Foundation Construction Co. of New York, is here.

F. H. Probert has returned to Berkeley from Washington and will proceed shortly to Colorado.

Philip Argall has returned to Denver from Cleveland, after a short holiday on the Great Lakes.

C. W. Purington is expected in San Francisco early in September on his way from London to Siberia.

Albert H. Fay, statistician to the U. S. Bureau of Mines, was here collecting data on industrial insurance.

Howland Bancroft has returned to Denver after having spent the past seven weeks in Washington on war work.

George E. Farish, who is re-opening the Devisadero mine in San Salvador, is sailing today on his return to the mine.

F. R. Roth, metallurgist at the smelter of the Burma Mines, has returned to San Francisco, to volunteer for military service.

F. W. Draper was in San Francisco at the end of last week, on his return to New York from inspecting mines in southern California.

John Seward has been assigned to the executive division of the General Staff, at Washington, with rank as major. He will specialize in war minerals.

R. G. Hall, general manager of the Herculaneum smelter, near St. Louis, has been appointed manager for the Burma Mines, Ltd., in Burma, succeeding **T. E. Mitchell.**

The whereabouts of **John Frank Bard**, who was at Salmon, Idaho, last year, and at Salt Lake City in January 1918, is desired by Edith Brown of 349 West 6th North street, Salt Lake City.

R. W. Derby, for seven years manager for the Powder River Gold Dredging Co. at Sumpter, Oregon, has resigned. **L. T. Roberts**, who has been dredge-master, has been named as Mr. Derby's successor.

G. H. Cox, of the department of geology of the University of Missouri, states that the School of Mines and Metallurgy at Rolla has signed its second contract for a Government training camp. At the present time 165 men are being given special instruction in electricity, gas engines, forge, machine-shop, and mining.

THE METAL MARKET

METAL PRICES

San Francisco, August 20

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30— 9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

ORE PRICES

August 20

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$24

'Chromite in 1917,' by J. S. Diller of the U. S. Geological Survey, has been issued. The domestic supply fell off 3310 tons in 1917 from the total of 47,035 tons in 1916. It is expected that the 1918 output will amount to 65,000 tons of all grades. A list is given of owners and operators of chrome mines in the United States.

EASTERN METAL MARKET

(By wire from New York)

August 20.—Copper is unchanged. Lead is scarce and firm. Spelter is strong and higher.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the Government price of $1, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce.

Date	New York, cents	London, pence
Aug. 14	99.62	48.81
" 15	99.62	48.81
" 16	99.62	48.81
" 17	99.62	48.81
" 18 Sunday		
" 19	101.50	48.81
" 20	101.50	48.81

Average week ending	
July 9	99.62
" 16	99.62
" 23	99.62
" 30	99.62
Aug. 6	99.62
" 13	99.62
" 20	100.25

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	....
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	....
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

On August 15 the U. S. Treasury announced that it had virtually fixed the maximum price of silver at $1.01½ per fine ounce, and that export licenses for silver would be granted by the Federal Reserve Board only for essential civil or military purposes, also on condition that the maximum price was not exceeded by the purchaser. On the 19th the new price was officially quoted by dealers in the metal.

The Shanghai Exchange eased to 4s.8½d. ($1.13) per oz. late in July. It is reported from India that the monsoon was, up to that time, less favorable than usual, particularly in the Bombay province. There is still plenty of time for better conditions to prevail. India has had such a succession of good harvests that a poor monsoon would not be of such importance as it would otherwise have been. Incidentally, such an untoward event would tend to curb the demand for silver coins.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date		Average week ending	
Aug. 14	26.00	July 9	26.00
" 15	26.00	" 16	26.00
" 16	26.00	" 23	26.00
" 17	26.00	" 30	26.00
" 18 Sunday		Aug. 6	26.00
" 19	26.00	" 13	26.00
" 20	26.00	" 20	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	23.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	....
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

Copper production of some of the large mines in July was as under:

Mine	Pounds
Cerro de Pasco	5,338,000
Davis-Daly (silver, 28,700 oz.)	625,057
Greene-Cananea (silver, 146,000 oz.)	5,000,000
Inspiration Con.	9,000,000
Shattuck-Arizona	672,000

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
Aug. 14	8.05	July 9	7.99
" 15	8.05	" 16	8.05
" 16	8.05	" 23	8.05
" 17	8.05	" 30	8.05
" 18 Sunday		Aug. 6	8.05
" 19	8.05	" 13	8.05
" 20	8.05	" 20	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	....
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Aug. 14	8.37	July 9	8.85
" 15	8.37	" 16	8.78
" 16	8.50	" 23	8.68
" 17	8.75	" 30	8.45
" 18 Sunday		Aug. 6	8.37
" 19	8.75	" 13	8.37
" 20	8.87	" 20	8.60

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	....
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
July 23	120.00	Aug. 6	120.00
" 30	120.00	" 13	120.00
		" 20	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	....
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	....
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ORES (New York)

Ferro-manganese: There has been no decided response to the official appeal that consumers contract ahead as far and as soon as possible. The market is firm at $250 per ton for 70% alloy, plus $4 per unit above this.

Tungsten: There has been fair activity and some sales at the ruling quotations of $20 to $24 and $24.50 per unit, the better grades going at the higher prices. Ferro-tungsten is quoted at $2.30 to $2.40 per lb. of contained tungsten.

Eastern Metal Market

New York, August 14.

Practically all the markets continue to be quiet and devoid of special interest, possibly with the exception of copper. This metal is active, after the announcement of a continuance to November 1 of the present fixed price of 26c. per pound.

Tin is still scarce and unchanged.

Lead is no more plentiful, but is maintained at a fixed price-level.

Zinc is fairly firm, because of a little more interest shown by consumers.

Antimony is practically unchanged.

Aluminum has a fixed Government maximum level.

The pig-iron output in July, according to the blast-furnace reports of the 'Iron Age', totaled 3,420,988 tons, or next to the largest this year. May holds the record of 3,446,412 tons. The daily output in July was 110,354 tons, which compares with 110,793 in June, and 111,175 tons in May, showing that it is not an easy matter to increase the output. Furnaces in blast on August 1 totaled 364, a net gain of 8 for July, the estimated daily capacity being 112,600 tons. July tin-plate production was 3,000,000 boxes, a good result. The most important event last week in the steel world was the award of the War Labor Board to the machinists of the Bethlehem Steel Co., involving an 8-hour day, collective bargaining, and the revision or discontinuance of the bonus system. Ship steel in process or in stock at shipyards and fabricating plants amounts to 1,000,000 tons. The War Industries Board seems confident that there will be no break in the shipbuilding program for lack of steel.

COPPER

It is difficult to say whether the expected or the unexpected happened at the meeting at Washington on August 7 to fix the price for copper. The new price took effect on August 15. The unexpected happened when it was raised on July 2 from 23.50 to 26c. per lb. On August 7 the price was continued at 26c. from August 15 to November 1 next. While many expected an advance to 27c., it now appears that there were many who did not look for a change, and they belong to the usual "I told you so" party. Anyhow there did not seem to be any decided dissatisfaction, but there is persistent talk that an adjustment upward on November 1 will be necessary, due to constantly advancing costs and other reasons. The heat both in the West and in the East, particularly, is not stimulating output. Around New York there has been over a week now of hot and humid weather. Many plants were forced to shut-down on August 7 because of the unprecedented temperature of 102° F. in the shade. This of course affected the copper refinery output, as over 90% of the country's copper is treated nearby. As a result of a settlement of the price for a definite period, there has been a big demand for the metal for delivery, to November 1 at 26c., and producers have been overwhelmed with inquiries and orders. Those desiring to buy beyond that date can only do so by contracting for the metal at the price ruling at the time of delivery. There is a rumor, unconfirmed, that the Price-Fixing Committee of the War Industries Board ruled that contracts made at the 23.50c. price, advanced automatically to 26c. in case shipment had not been made prior to the date the new price of 26c. went into effect, or prior to July 2. Jobbing lots, 5 tons and less, rule of the fixed maximum price of 27.35c. per pound.

TIN

The market continues quiet with consumers not anxious on the surface, and fewer showing little interest. They are awaiting probably the results of important deliberations in London, where a conference is to be held as soon as possible by a group of tin experts, including part of a special mission from the United States government. The two representatives of this country are John Hughes, chairman of the subcommittee on tin of the American Iron & Steel Institute, and George M. Armsby, chief of the tin section of the War Industries Board. They are to study the entire tin situation of the world, and it is expected that some arrangement will be made that will facilitate trading between America and England. Difficulties are now many and exasperating. Imports of the metal continue large. For the 11 months ended May 31, the receipts of tin in bars, blocks, pigs, etc., were 121,153,105 lb., of which 28,000,000 lb. came from the United Kingdom and 48,520,000 lb. from the Straits Settlements. For the 11 months ended May 31, 1916, or two years ago, the total was 123,956,905 lb., of which 35,000,000 lb. came from the United Kingdom and 73,000,000 lb. from the Straits Settlements. This shows the great change in sources. Still another instance, however, is the receipts from the Dutch East Indies. In the 1918 period these imports of Banca tin were nearly 22,000,000 lb., contrasted with 10,000,000 lb. in the 11-month period of 1916. The London market is lower, Straits tin on August 12 being quoted at £387 10s., compared with £394 10s. per ton the week before.

According to the market report of Henry R. Merton & Co. of London, dated July 20, arrangements have been made by the British authorities controlling supplies and prices of tin, that in future offers will be regulated in such a way that the offers to America will be more on equality with the prices ruling for the United Kingdom.

LEAD

The feature of this market continues to be the scarcity of the metal. Government needs come first, and when those are taken care of there seems but little left for other purposes. Production is large, but not at present equal to the demand. There are evidences of some speculation, certain brokers having small stocks being able, it is said, to part with them at prices above the agreed maximum average among producers, which continues to be 7.75c., St. Louis, or 8.05c., New York. Such speculative lots have gone as high as 8.75c. per lb. New York for spot delivery, an instance of one car at this price being noted.

ZINC

The tone of the market is a little stronger than a week ago, but the change is not of much consequence. The Government is buying again, 3000 tons having been purchased in the last few days. There is a little more inquiry. Prime Western for August-September delivery is quoted at 8.12½ to 8.25c., St. Louis, or 8.37½ to 8.50c., New York. Grade A spelter is fixed at 12c. per lb. as a maximum Government price. Sheet-zinc is regulated at 15c. per lb. with plate-zinc at 14c. per lb., both maximum prices.

ANTIMONY

Quietness continues to characterize this market. Quotations are unchanged at 13 to 13.25c. per lb., duty paid, New York, for prompt and early delivery of Chinese and Japanese grades, the only metal available.

ALUMINUM

Government maximum prices govern this market. No. 1 virgin metal 98 to 99% pure, and also scrap, in 50-ton lots are held at 33c. per lb., in 15 to 50-ton lots at 33.10c. per lb. and in 1 to 15 tons at 33.20c. per pound.

Company Reports

Reports of the silver mines at Tonopah, Nevada, are as follows:

TONOPAH BELMONT DEVELOPMENT CO.

Property: silver mine and mills at Tonopah, Nevada; also controls the Belmont Surf Inlet Mines, Ltd., in British Columbia, Belmont Shawmut Mining Co. in California, and Belmont Wagner Mining Co. in Colorado.

Operating Officials: (at Tonopah) Frederick Bradshaw, general manager; T. F. M. Fitzgerald, mine superintendent; L. R. Robins, mining engineer; G. H. Garrey, consulting geologist; A. H. Jones, superintendent of milling; W. H. Royston, mill superintendent; and Temple Jackson, auditor.

Financial Statement: this covers the period ended February 28, 1918, and may be compared with previous years as under:

	1917-'18	1916-'17	1915-'16	1914-'15
Gross value of ore	$2,171,521	$2,531,737	$2,332,253	$3,037,435
Loss in treatment	123,017	165,746	171,730	231,066
Value realized	$2,048,504	$2,365,991	$2,160,523	$2,806,369
Operating expense	1,097,802	1,112,349	1,170,107	1,304,379
Net profit, including other income, less taxes, etc.	$1,018,125	$1,245,100	$1,001,028	$1,456,698

Current assets total $966,790, and liabilities $292,268, including $105,656 for taxes due. Investments, in subsidiaries, total $1,913,214. A large part of the surplus assets have been converted into the capital stocks of new companies organized to take over and operate properties under option agreements. To the end of the financial year $1,291,410 had been spent on the Surf Inlet mine.

Dividends: in 1917-'18 amounted to $750,018, making a total of $9,518,063 since 1906.

Development: at Tonopah, new work completed amounted to 14,437 ft., 25% less than in 1916-'17. This did not add to the reserves, which are estimated at 75,823 tons.

Treatment Plants: the Tonopah mill treated Belmont ore only for 9 months, after which it received ore from the Jim Butler and Tonopah companies, on a custom basis. Each lot of ore is crushed, weighed, and sampled separately before being distributed to the battery bins, the system being entirely satisfactory. The plant for treating sweepings from tailing ponds worked from April to December—the season. The mill at Millers worked until December as a custom plant, after which it was shut-down and partly dismantled. During 11 years it treated 568,345 tons of ore valued at $11,989,513.

Production: from the company's mine this was as follows, compared with previous years:

	1917-'18	1916-'17	1915-'16	1914-'15
Ore treated, tons	131,100	144,762	165,157	181,424
Value per ton	$16.57	$17.45	$14.13	$16.74
Extraction, per cent	94.05	93.35	92.97	92.99
Gold, ounces	19,953	27,831	31,112	40,591
Silver, ounces	1,946,757	2,629,466	2,968,565	3,714,862
Silver av. per ounce, cents.	84.13	69.30	51.76	55.16

Costs: these were as follows for the last four years:

	1917-'18	1916-17	1915-'16	1914-'15
Mining	$4.439	$4.179	$3.800	$4.020
Treatment	3.204	2.897	2.699	2.560
General	0.826	0.678	0.683	.....
Total net	$8.381	$7.670	$7.093	$7.190

TONOPAH EXTENSION MINING CO.

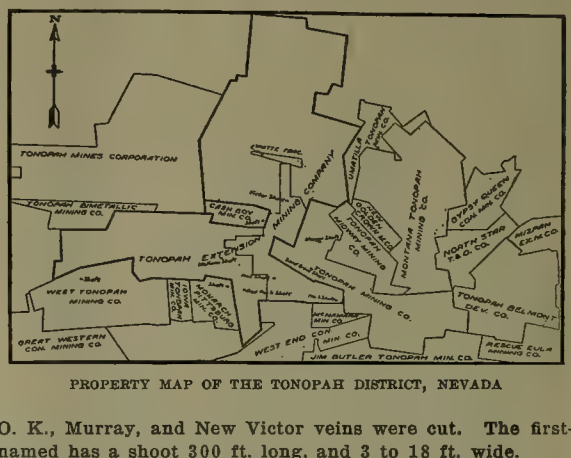
Property: silver mine and mill at Tonopah, Nevada.

Operating Official: J. G. Kirchen, general manager.

Financial Statement: during the year ended March 31, 1918, sales of silver and gold realized $1,250,983. After paying all accounts there remained a profit of $230,332, compared with $673,394 in 1916-'17.

Dividends: none was paid, the total remaining at $1,912,-399.

Development: at No. 2 shaft 3910 ft. of work was done, and 7067 ft. at the Victor. Operations at 660, 850, and 950-ft. levels of the former shaft consisted of stoping on the Murray vein, where a small quantity of ore remains. At 1170 ft. the Murray and Merger produced poor ore. At 1260 ft. the No. 2 Merger Footwall vein yielded the best ore during the year. At 1350 ft. the Murray and O. K. veins are worked out. At 1440 ft. the Murray supplied a large quantity of average-grade ore, so did the Merger and O. K. Indications on this level are good. At the Victor shaft, 1759 ft. deep, the Murray at 1540 ft. was stoped out. An intermediate level has exposed a good shoot. Pumps are to be placed at 1680 ft. in the shaft. On this level the Merger,



PROPERTY MAP OF THE TONOPAH DISTRICT, NEVADA

O. K., Murray, and New Victor veins were cut. The first-named has a shoot 300 ft. long, and 3 to 18 ft. wide.

Production: a comparison of previous years shows:

	1917-'18	1916-'17	1915-'16	1914-'15
Ore treated, tons	110,188	109,402	91,981	71,882
Value per ton	$12.543	$17.107	$18.038	$19.966
Extraction, per cent	90.51	.....	92.39	89.57
Silver, ounces	1,169,671	1,882,402	2,106,519	1,790,032
Gold, ounces	11,809	18,052	20,576	17,585
Costs per ton	$8.64	$8.82	$9.59	$9 39

TONOPAH MINING CO.

Property: silver mines at Tonopah and mill at Millers, Nevada.

Operating Official: W. H. Blackburn, superintendent.

Development: three main shafts were operated during 1917. All work is done on day shift only. A new shoot was discovered between the 1400 and 1000-ft. levels on the upper Sand Grass vein. In mining old pillars, or in cleaning out old stopes, small orebodies are found. No estimate of reserves is possible. Ore-house rejects, up to 5635 tons, assaying $5.78 per ton, were treated profitably in a month.

Production: a comparison shows the following:

	1917	1916	1915	1914
Ore treated, tons	109,835	*81,782	136,246	143,422
Value per ton	$14.80	$15.65	$13.66	$16.25
Extraction, per cent	91.9	90.1	.....	.....
Silver, ounces	1,443,368	.....	.....	.....
Gold, ounces	16,929	.....	.....	.....
Cost per ton	$9.159	$8.71	$7.78	$8.51

*9 months only.

Subsidiaries: the three dredges of the Tonopah Placers Co. at Breckenridge, Colorado, worked nine months.

At the Eden Mining Co.'s property in Nicaragua, the mill was closed on account of power shortage. There will soon be 1400 hp. available. Costs have risen so much that the ore must be of 50% higher value than before the War.

At the Tonopah Nicaragua property, in Nicaragua, drilling will be completed about the middle of 1918.

The Mandy Mining Co. in Manitoba, Canada, produced 8500 tons of ore during the past winter. This was sent to smelters when navigation opened. From December 1916 to June 1917 there was shipped 3335 tons of ore containing

1,113,935 lb. of copper (equal to 17%), 337 oz. of gold, and 7560 oz. of silver. This was worth $231,730. The net result was a loss of $11,413.

The Tonopah Canadian Mines Co. and Brutus Mining Co. may be wound up if the properties fail to develop better.

WEST END CONSOLIDATED MINING CO.

Property: silver mines and mill at Tonopah, Nevada.

Operating Officials: J. W. Sherwin, superintendent; F. C. Ninnis, mill superintendent.

Financial Statement: receipts in 1917 totaled $1,335,214, including $1,044,896 from ore reduction. The balance remaining after operations, mill rental, deposits in escrow for ore suit, ore purchased, and dividends had been paid for was $47,656. Current assets total $911,147, including cash and bullion $346,734, deposits in escrow for disputed (with Jim Butler company) ore $376,701, loans receivable $52,000, stores $80,116, and litigation appropriation $30,000. Liabilities total $572,377, inclusive of disputed ore and interest $376,701, and depreciation reserve $143,020.

Dividends: $89,424 was distributed.

Development: the Ohio shaft was sunk to 1212 ft., and 4923 ft. of lateral work was done from this and 2702 ft. from the West End shaft. In April a new vein was found on the Ohio 500-ft. level. Owing to its low angle of dip this ore has been opened by foot-wall cross-cuts and raises therefrom. Twenty have been put up, fifteen being in commercial ore, the remainder being second-class ore. Of the lateral work on this vein—1225 ft.—1010 ft. was in profitable ore, the remainder on second-class ore. Between April and December the orebody had yielded 11,837 tons valued at $250,000. Reserves consist of 10,333 tons of positive ore valued at $206,660, 35,905 tons of probable ore worth $1,015,633, and 61,111 tons of possible ore. But the vein is irregular, and estimates are difficult. The vein is in trachyte, a good ore-bearing formation at Tonopah.

Production: the mill and cyanide plant treated 45,910 tons of company ore, averaging $15.73 per ton. This contained 7161 oz. gold and 677,117 oz. silver, of which 94.56% and 92.67%, respectively, was extracted. The bullion was worth $1.055 per fine ounce. Custom ore treated amounted to 20,923 tons. The total bullion extracted was 12,854 oz. gold and 1,219,860 oz. silver. A number of improvements were made at the plant.

Costs, per ton:

	1917	1916
Mining	$3.34	$2.95
Development	1.87	1.43
Treatment	3.27	3.42

INTERNATIONAL NICKEL CO.

Property: through subsidiaries the company operates nickel-copper mines at Sudbury, reduction-works at Copper Cliff, Ontario, and a refinery in New Jersey. A new refinery has been erected in Ontario. The capital is $62,000,000, of which $50,747,200 is issued. There are now 12,824 shareholders, against 9252 a year ago.

Financial Statement: this covers the year ended March 31, 1918, and may be tabulated as under:

Net earnings of all properties	$15,791,485
Other income	390,016
Total	$16,181,501
Administration charges	610,024
Federal and State taxes	3,590,836
Plant depreciation and mineral exhaustion, etc.	1,850,654
Net profit	$10,129,988

Current assets total $17,638,387 and liabilities $7,630,017.

Dividends: preferred stock received four (No. 47 to 50) of 1½% each, amounting to $534,756; and common stock one (No. 33) of 6% and three (No. 34 to 36) of 4% each, totaling $7,530,228.

Mining Decisions

Percentage of Extraction—Evidence Necessary

Courts cannot take judicial notice of what percentage of mineral can be extracted from a particular class of ore, it being a matter of proof for each particular case. It has been held, however, that a court will take judicial knowledge of the fact that such extraction will not be 100%.

Dixon v. Southern Pacific Co. (Nevada), 172 Pacific, 368.

Mining Partnership—Limits of Duration

Mining partnerships exist between co-owners only when they actually engage in working the property. Before actual operations begin, and after actual operations cease, they are simply co-tenants, unless, of course, an ordinary partnership has been formed. A receivership may, however, be legally based on such co-tenancy.

Huston v. Cox (Kansas), 172 Pacific, 992.

Grant of Mineral Rights—Incidents

A grant or reservation of mineral under the surface carries with it, or reserves, the right to use so much of the surface as is reasonably necessary for mining such material. In the absence of a provision in the deed to the contrary, however, the owner of the mineral right must provide subjacent support, and protect the surface against subsidence.

Hammarstedt v. Bakeley (Iowa), 166 Northwestern, 729.

Oil-Well Drilling—Damages for Breach of Contract

When a land-owner breaks a contract with an oil-well driller for the drilling of a well to a certain depth and refuses to allow him to proceed, the measure of damages is properly stated as the cost of moving the rig and drilling machinery to the point of operation, setting them up and drilling to the point of interruption, together with reasonable compensation for the driller's services and loss of time.

Letcher v. Maloney (Oklahoma), 172 Pacific, 972.

Mine Promotion—Stock Option Construed

An option on mining shares, "to be taken and paid for in such sums and amounts as may be required in prosecution of the work of the development of the company's property," was only an option to purchase so much of the stock as was required to pay for development work, and ended when the mine became self-supporting.

Woldson v. Richmond Mining, Milling & Reduction Co. (Washington), 172 Pacific, 1162.

Annual Labor—Value of Improvements

The actual cost of labor and materials expended in the performance of annual labor on a mining claim is competent evidence to show the good faith of the parties doing the work, but is not conclusive upon the question of the value of the improvements. Where the actual cost was shown to have been $15 to $25 per foot, but the testimony supported the finding that work was actually worth $35 per foot, the finding of the trial court based on conflicting evidence will not be disturbed on appeal. A party owning six adjoining claims may apportion the value of the work done on any one of them for the benefit of all of them in any way he sees fit. The apportionment need not be uniform, and if he elects to apply all the work to a portion of the claims and forfeit the remainder, he may do so. Resumption of work on another group prior to adverse re-location will prevent forfeiture thereof.

McKirahan v. Gold King Mining Co. (South Dakota), 165 Northwestern, 542.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

THE CINCH ANCHORING SYSTEM

The need of an adequate system of fastening ornamental and structural fixtures to concrete, cement, and other masonry was not met fully until the introduction of the Cinch system. A Cinch expansion-bolt consists of a conical-wedge male part of malleable iron either plain or threaded, and a lead-composition female part. The plain two-unit anchorage consists of two of each of the above parts, neither of which is threaded, while for a threaded two-unit anchorage one of the iron parts is threaded. There are three kinds

FIG. 1 AND 2. PLACING AND CAULKING UNITS.

of Cinch anchorage specialties—the Cinch expansion-bolt, Cinch anchor, and Cinch stud-anchor—all of which are combinations of the units above described, together with either a standard machine-bolt or a stud-bolt. Since these anchorages are made of malleable-iron and lead-composition units, a complete cylindrical surface-contact is made with the walls of the hole, whether it be regular or irregular. Vibration will not loosen the hold since all parts are under complete restraint.

As shown in Fig. 1 the head of the bolt and the first unit are first placed in the hole. The unit is expanded by means of the caulking tool as shown in Fig. 2. Other units are added as required, each unit being expanded as it is put in place. After all have been expanded the piece to be hung is placed and the nut screwed on the bolt, an operation of but a few seconds. When it is desired to use a stud-bolt or to have the head of the bolt outside the work the same caulking method is employed. A threaded iron wedge is screwed upon the end of the stud-bolt and with the first alloy is placed in the hole. This is caulked in place and is followed by a plain iron wedge with its alloy, which is also caulked in place. The stud-bolt can now be unscrewed, leaving the expanded units in the hole. When ready to attach the work the bolt is engaged with the threaded wedge in the bottom of the hole. A plain piece of pipe can be used instead of the caulking tool if desired. These Cinch anchorages are carried in stock by Harron, Rickard & McCone, of San Francisco.

COMMERCIAL PARAGRAPHS

The Ducktown Sulphur, Copper & Iron Co., Copper Hill, Tennessee, is planning extensions to its works to increase the present capacity. These will include the erection of several new structures.

The Ontario Smelting Co., Ontario, Ohio, has increased its capital from $250,000 to $500,000 for extensions and improvements. The company is planning to erect an addition.

The Copper Exploration Co., Wilmington, Delaware, has been incorporated with a capital of $2,000,000 to operate copper properties. F. D. Buck and J. D. Frock, Wilmington, are the incorporators.

The Globe Smelting & Refining Co., Passaic, New Jersey, has been incorporated with a capital of $50,000 to operate a plant in that vicinity. Benjamin Friedman and Morris Lefferts, Passaic, are the incorporators.

The American Zinc, Lead & Smelting Co., 120 Broadway, New York, is said to be having plans prepared for its new smelting plant near Mascot, Tennessee. In connection with the smelter will be an electrolytic plant for zinc production.

The American Tin & Tungsten Co., 50 Broadway, New York, has secured additional operating capital and is planning for the immediate operation of its properties. This work will include the mining of ore and the operation of the existing milling plant.

The American Sheet & Tin Plate Co., Frick building, Pittsburgh, Pennsylvania, a subsidiary of the United States Steel Corporation, is having plans prepared for the construction o fa large addition to its works at Gary, Indiana, to cost in the neighborhood of $10,000,000. The buildings will consist of 24 tin-plate mills.

The Jonathan Bartley Crucible Co. advises us that on August 7 its No. 2 plant was partly destroyed by fire. All business that has been placed with the firm will be taken care of as usual, with practically no delay. New equipment has been ordered and repairs were commenced on August 12; the renewed works should be in operation by November 1.

Mining and Scientific Press

Edited by T. A. RICKARD

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Number 9

SAN FRANCISCO, AUGUST 31, 1918

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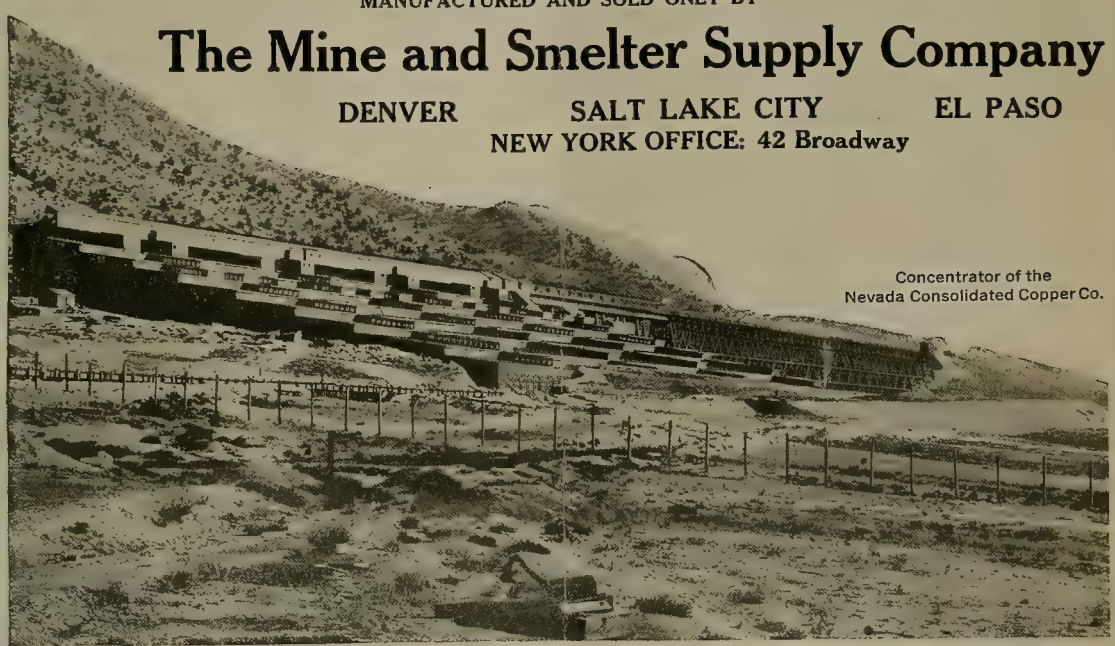

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Nitrate Deposits of South-Eastern Oregon

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M. W. von BERNEWITZ, Assistant Editor

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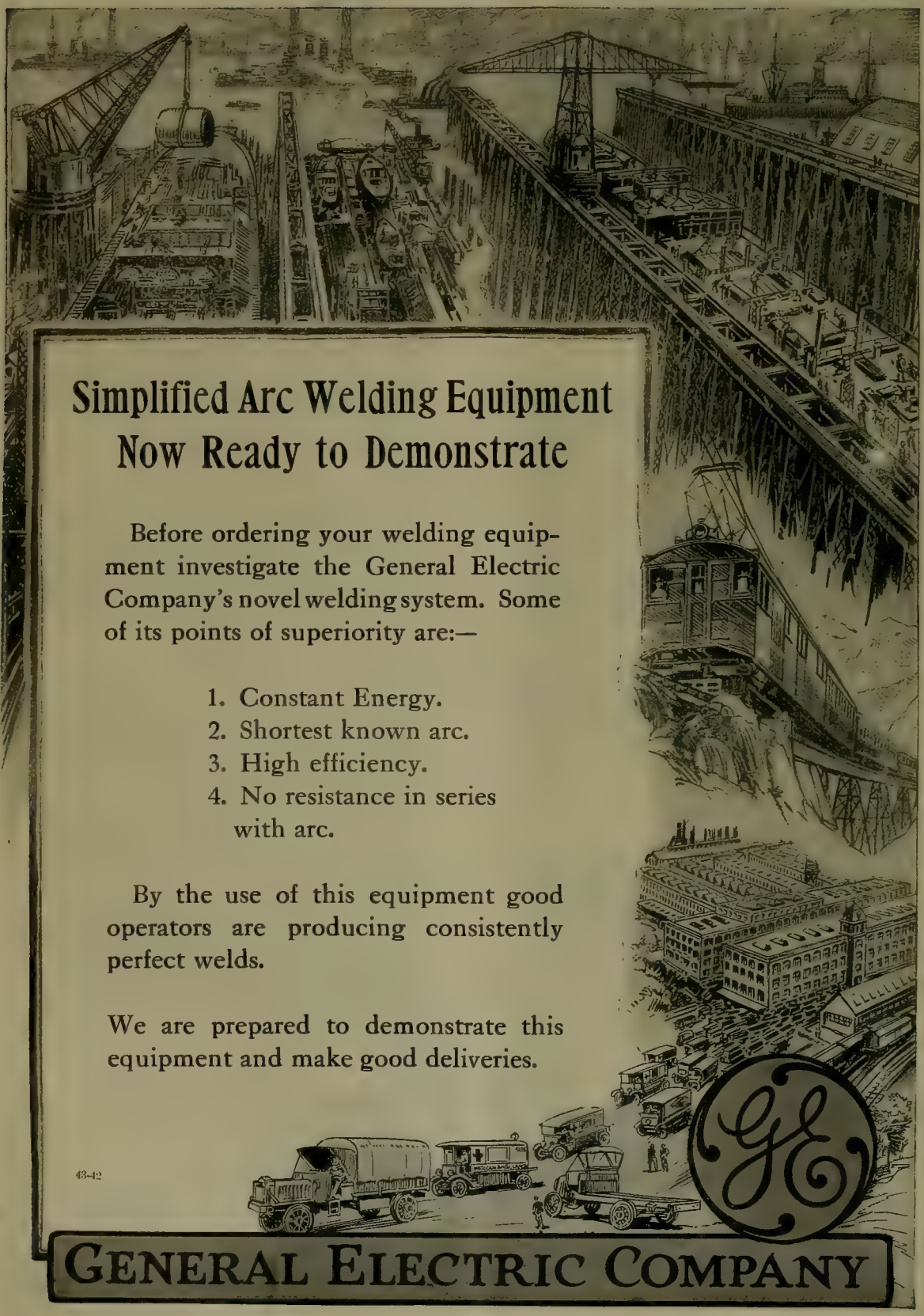

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EDITORIAL

LAST week we published a letter from the Front; this week we publish another, feeling certain that they will be read with keen interest. We hope our friends in France and Flanders will avail themselves of the opportunity of sending an occasional greeting, by way of a published letter, to the folks at home. We want to keep in touch with our gallant defenders.

PRESIDENT WILSON'S autograph appeal on behalf of the fourth Liberty Loan is to appear on September 24. It should prove a great help to subscription, for the President has won the confidence of the people and is today recognized as the leader of the embattled democracies of the world. The drive for the next Liberty Loan is set for September 28. This time the flow of subscription should be stimulated by the victorious offensive made by our troops in France; the country must show them that their splendid efforts are appreciated, by over-subscribing the loan.

IMPORTANT additions to our supply of sulphur are being made by the coal mines. Steps were taken in Illinois some time ago to concentrate the pyrite, which occurs in bands, nodules, and lenses, in coal seams, and the same thing is being done in Ohio, West Virginia, and other States. Mr. Wilbur A. Nelson, the State Geologist of Tennessee, announces that several of the larger mines of his State are producing large quantities of that mineral, assaying above 42% in sulphur. The utilization of this valuable by-product is not only helpful at the present crisis, but is in conformity with the principles of true conservation. It will add to the revenue of the coal mines, both now and after the War, and will tend to make the United States independent of imports from abroad.

OUR excellent contemporary 'The Wallace Miner' reproduces the letter by Mr. Thane appearing in our issue of August 3, in which the proposal was made to increase the 'price' of gold to $40 per ounce, and itself publishes a letter from Mr. Chester T. Kennan, in which it is proposed to fix the price of gold at $30 per ounce. Needless to say, we consider such schemes utterly impracticable, if not absurd. The United States is not an island in the Pacific, but one of a comity of nations doing business under an established monetary standard, which cannot be changed except by international agreement. Our own comment on the status of gold mining will have made it clear that we would not for a moment support a proposal so revolutionary, but we do think it feasible to encourage the production of gold by paying a royalty on the metal when produced at the mine.

DESPITE the fact that we have tried, not unsuccessfully perhaps, to give our readers all the information available concerning the mining and marketing of chromite, manganese, magnesite, and other war-minerals, we receive letters asking for data that have appeared again and again in our pages. Since July 1914, for example, we have published 26 pages on chromite and 12 pages on magnesite, not including notes, every week, on the market for these products. Two thousand pamphlets on chromite, by Messrs. Burch and Dolbear have been printed by us and distributed broadcast. Further information concerning the concentration of chrome ore and the preparation of manganese ore for the market is desirable, and we hope that engineers having experience in these matters will aid the national cause by contributing notes on these subjects. Too many people consider the matter that we publish insufficient unless the affairs that lie nearest to their own hearts are given undue publicity. They only need to be reminded of this to appreciate the value of proper proportion. Read this paper carefully, be grateful to the contributors that furnish guidance from their experience, and 'chip in' yourself when you can do so for the general good.

IN the resolutions passed by the American Gold Conference at Reno on August 12, it was stated in the first paragraph that "the [gold] production of California alone having declined $3,000,000 in the first six months of the present year * * *." This is incorrect. An investigation made for the United States Geological Survey by Mr. Charles G. Yale shows that the newly-mined gold received at the depositories in San Francisco for the first six months of 1918, was $1,174,500 less than in the corresponding period of 1917. The State showed a reduction in gold yield of $1,323,237 in 1917, as compared with 1916, so that, on the basis of the above estimate for 1918, the deficit in the output of gold for two years will be $3,672,237. On the other hand, it is well known that two of the leading gold mines of the State are continuing

production at a loss, and must soon cease unless aid be extended; the famous old La Grange hydraulic mine in Trinity county has made its last clean-up; and many other mines are struggling against adversity in the hope that something may happen soon to save them from financial destruction. Therefore the decline during the first half of the current year is not a measure of what will happen in the latter half. The fact that the decrease in gold production in the six months ended June 30 was almost as great as that recorded in 1917, compared with the output in the previous year, may be taken as evidence of a rate of decline that is alarming. If the rate be accelerated in that proportion gold will soon cease to appear in appreciable amount among the products of what was once justly named the Golden State.

NEWS from the Front continues to be splendid. Each of the principal Allies has dealt the Enemy a hard knock, and in such quick succession that he staggers backward to his old defensive line. Our casualties have been relatively small, while the German loss is great enough to prove that he is being out-fought and outgeneraled. This is no time, however, for prophesying a speedy ending of the War; it is a time for concentrating all our energies on fighting it with increasing intensity, so that the German may learn what it means to be invaded, to be bombed, to be driven from hearth and home, to be subject to the pain and horror that he did not scruple to bring upon his peaceful neighbors. All our effort, all the losses of the Allies, will have been in vain—a tragedy so stupendous that it is unthinkable—unless the Germans are deterred from ever again backing their leaders in a mad and murderous ambition to subjugate other nations, and unless the Germans themselves are driven, by the logic of events, to bring those leaders to account. This is no time for boasting nor for complacent satisfaction with our military and naval successes; we must see the thing through to the end, and that end is expressed by two words: Never again.

ANNOUNCEMENT is made in dispatches from Madrid that a diplomatic agreement has been reached between Ambassador Willard and the Spanish government whereby a credit of $100,000,000 will be established in that country for the benefit of the United States, to be applied in the purchase there of supplies needed by our Army in France. This advance will be covered by consignments of cotton and other raw materials urgently needed in Spain. It is a happy arrangement, and will help to cement cordial relations between the two countries. After some minor friction, induced by the pernicious activities of German propagandists in the Peninsula, this *entente cordiale* is most opportune, coming as it does at a moment when the irritation of the Spanish government has grown acute over the persistent sinking of Spanish ships. No one can account for the psychologic dullness of the Teutons, which allowed them to arouse the animosity of the American people, and has again led them to affront the Spaniards, who were disposed to maintain a rigid neutrality. They evidently counted too heavily on the somewhat remote blood-relationship of King Alfonso with the House of Austria. They seem to have forgotten that he has shown a conspicuously democratic spirit, which has made him a popular ruler in a sense that the Hohenzollerns have never realized. A declaration of war between Spain and Germany is wholly probable, and the work being done by Ambassador Willard is demonstrating that the Spanish government may count upon our friendly co-operation.

Gold After the War

In this issue we publish another letter from Mr. Benedict, continuing his useful and timely effort to clarify the terms used in the economics of gold. It is well to take pains not to confuse such terms as 'price' and 'value,' one being exchangeability in money and the other in commodities. 'Price' is the money for which a thing is bought or sold; 'value' is the exchangeability of a commodity in terms of other commodities, of which money is only one. We note that another Gold Conference is to be held, at Spokane, on September 5. We venture to suggest to those participating in the discussion that they take care to use economic terms circumspectly, so as "to avoid confusion and prevent imposition," as is stated not infrequently in public notices. Apparently the Conference at Spokane will follow the lead of that at Reno in being conservative, that is, in rejecting impossible schemes for 'raising the price' of gold, while advocating the payment of a royalty on newly produced metal, an increase in the facilities for transportation, an immunity from Federal taxation, and other helps to an industry now threatened with extinction. It is pleasing to note that the Northwest Mining Association has asked representatives of the American Gold Conference to co-operate at the forthcoming convention at Spokane. On another page of this issue we give an abstract from a thoughtful article appearing in a recent issue of 'The Annalist.' It is worthy of serious attention. The expectation that gold will be in such demand as to command a premium, after the War, if not before it ends, has troubled many men whose experience in finance has made them conscious of the calamity that would result from such a derangement of the money market. A premium on gold signifies a scarcity, and in times of war or political disturbance this shortage is commonly produced by hoarding. Gold, as the measure of value, is a sensitive medium of exchange, and when large amounts of it are in circulation it shrinks into hiding at the first symptoms of over-strained credit. Gold can then go to a premium, but it cannot do so except there be a considerable quantity of it in the possession of individuals. It is the fact of it being offered in the market, appraised by the holder at a high equivalent in terms of the circulating credit-money, that gives it what we call a 'premium.' If the gold is all gathered at the Treasury, that is, in the hands of the collective people, it cannot go to a premium. Our Government has wisely expanded its Treasury-reserve; it has placed it in the vaults at Washington, and

in the keeping of the Federal Reserve Bank as a basis for loans to the National banks; and only a fraction of the total remains in private hands. Even the majority of that small portion is held by State banks, and is not beyond Federal control. So far as the United States is concerned, the safeguards against disturbance of our currency by a premium on gold would seem to be ample. The exchange-value of the circulating medium may be subject to discount if the quantity is in excess of commercial needs at a moment of contraction in the production of commodities, or if the gold foundation for the outstanding currency should prove inadequate. We are not in that position today, and the importance, for financial reasons, of maintaining a steady flow of gold from the mines to the Mint is the valid argument of the gold-producer for Federal assistance at this particular time. *Aprés la guerre* the Germans might be able to do business on three bases: goodwill, credit, or cash. For goodwill they have exchanged, and will continue to receive, during many long years, detestation. Their credit will be shattered, for bankruptcy stares them in the face. They can do business with the civilized world only on a cash basis, and that means gold, and more gold, to obtain which they will have to sweat blood. Their insistent demand for gold will be a prime factor in causing an appreciation as helpful to the miner as the present depreciation, in terms of other commodities, has been crippling. However, the belief that such will be a consequence of the War furnishes no excuse for failure to aid the gold-mining industry now, because every engineer knows, and those in authority, whether executive or legislative, should understand that the cost, in time and money, of reopening a mine that has been idle, is excessive, as compared with the profit to be made therefrom. The economic waste of shutting-down the gold mines and of restoring them later to productive activity ought to be avoided if it be at all possible.

Gold-Dredging and Electric Power

The shortage of electric power in California becomes worse as the dry season advances. The State Director of Power, Mr. H. G. Butler, is urging drastic economy in the use of hydro-electric energy until the reservoirs become filled by the autumn rains. At the present rate of consumption for all purposes in northern California—5,000,000 kilowatt-hours per day—the water stored may be exhausted before the end of the year. An early rainfall is not dependable. It is proposed to reduce the consumption of power for the next two months by 15,000,000 kilowatt-hours per month, equal to 10%. To do this, cement-plants, gold-dredges, and rock-crushing plants, which use 5,000,000, 11,000,000, and 3,000,000 kw-hr., respectively, per month, are to be allotted less power. In a telegram to Mr. McAdoo, Mr. Butler said: "We are convinced that taking off the gold-dredge load would work the least injury to the War needs, and propose taking off this load unless you advise that gold production is equally essential to shipbuilding, food production, transportation, and other direct war industries. Rainfall will probably relieve the situation in three months, possibly before." From this it would appear that gold mining is not included, only dredging. Although the power needs of shipyards, ironworks, munition-plants, irrigation, and food industries, are vital, we venture to protest against this latest order. The Priorities Commission of the War Industries Board recently declared gold to be an essential, and good suggestions have been offered to relieve the crisis, yet dredging, which contributes 14% of the American production of gold, and 41% of that from California, is to be curtailed. A dredge uses a good deal of power, a 15-cubic foot boat of the Natomas company, in fairly tight ground, consumes a total of 1072 horsepower; yet this is the cheapest method of recovering gold from the earth. On one of the dredges of the Powder River company in Oregon the cost of production during the last financial year was $7.40 per ounce of gold. The Natomas company in 1917 recovered 111,000 ounces of gold at an approximate cost of $10.80 per ounce. Compare this with $13.25 per ounce extracted from ore mined and milled at the Plymouth mine, one of the best equipped in the Mother Lode region. Other lode mines show a much higher cost. Some recent statistics of the U. S. Geological Survey, prepared by Mr. Charles G. Yale, bearing on the relation of gold-dredging to total production are illuminating: The gold output of California in 1917 was $20,087,504, a decrease of $1,323,237 when compared with that of 1916; the value of the yield from deep mines declined 14.19%; while that from placer mining showed a gain of 5.81%. Dredges recovered $544,300 more than in 1916. The only increase in 1917 was from dredges. Lode mines contributed 55% and placer deposits 45% of the 1917 output, against 60% and 40%, respectively, in the previous year. Dredges saved 41% of the Californian gold in 1917, equal to 92% of the yield from placers. Yuba—a dredging region—was the only county to show an increase in gold. There were 55 boats operated in 1917, a decrease of five. From 1898 to the end of 1917, the dredges have dug gold worth $95,186,985. Platinum is considered by the Government to be highly necessary, yet, if the dredges are stopped, 90% of the new platinum produced in America will be cut off. The quantity—460 ounces in 1917—is not large, but, in view of conditions in Russia, every ounce counts. It has been officially computed that mining throughout California consumes 15.5% of the total power generated, manufacturing 30.5%, and commercial lighting 14%. The last mentioned is practically equal to the first, but what is its actual value? If 150,000,000 kw-hr. is used each month for all purposes in the State, and 11,000,000 kw-hr. is consumed by gold dredges, they use 7.3% of the total; yet commercial lighting uses 14%. On the one hand, one kilowatt-hour produces 12 cents of new gold, the basis of international credit; while one kilowatt-hour for lighting is relatively non-productive. There is no more need for bright street-lights and signs on Saturdays and Sundays than on the other nights when they are prohibited; also much more power can be saved by reducing

the number of cars running in the streets of our cities. Let the people walk more. Although the price of power was raised 26.6% in July, dredging companies make no plaint on that score, as they are charged a low rate, naturally, as their load-factor is high. On August 21, representatives of the dredging industry waited on Mr. Butler, and, the matter being explained to them, they decided voluntarily to curtail dredging by 33%, until there is enough water for the normal generation of power. There are now 47 dredges working in the State, from Merced in the south to Lewiston in the north. Probably the Yosemite company's dredge on the Merced river and one or two on the Trinity river will not be affected by the ruling; but out of the remaining 42 dredges, 14 will suspend digging for fully three months. The Yuba Consolidated is to stop one 17 and three 7½-cu. ft. dredges, out of eight. The Natomas company will probably shut-down as many; it has 11 at work. The decision is hard on the new dredges in the Redding district, and will certainly make capital shy of going into such ventures, for this adversity may recur. A suspension of 33% of the dredging capacity for three months will reduce the 1918 gold output of California by fully $2,000,000. Is it not a blunder to curtail the production of gold at this time, when other less necessary industries, even luxuries, are consuming electric power?

Nitrate Deposits

The problem of nitrogen fixation is one of perennial interest. The farmer is vitally dependent upon nitrates; the chemist has not yet succeeded in providing the soldier with a reliable, convenient, and sufficiently forceful explosive without taking advantage of certain delicately balanced molecules into which nitrogen enters. For this reason discussions of the origin of nitrates in nature are always welcome, and the article by Mr. Ira A. Williams on the nitrate deposits of south-eastern Oregon, published on another page of this issue, will be read with interest. The conclusion may be drawn from it, as well as from articles and bulletins on nitrate deposits in various parts of the United States written by other observers, that they might almost have treated the subject in the manner of the Celtic historian who won a famous record for brevity in his laconic, but negative, chapter on snakes in Ireland.

The fact is, however, that nitrates have been found in a few localities in sufficient quantity to entice well-meaning and too courageous capitalists to expend money unwisely in a hopeless quest. Mr. Williams adds his warning to that of Mr. Hoyt S. Gale, who discussed the same subject in our columns last November. From this time forth the importance of nitrate deposits will decrease steadily. The only really great commercial bodies of such salts in the world are in Chile, and no great nation will hereafter depend wholly on that distant country for its fixed nitrogen, since technical progress has shown the way to draw it from the atmosphere economically by aid of the electric current at a rate that makes the azotobacteria seem more old-fashioned than a metallurgist of the days of King Og of Bashan. Man will harness the water-powers to fix his nitrogen in future; he will presently do it for less than the cost of leaching and evaporating it from the caliche in Chile; and those economists who had thought of proposing fixed nitrogen as a safe measure of value in a highly cultured currency must despair of ever finding a stable monetary unit. The question of the origin of natural nitrates, therefore, is more academic than important, aside from the application of the argument made by Mr. Williams to disillusion those who seek nitrate in the solid rock. It is a notable fact that the accumulations of nitrate in this country, except as they remain here and there as fractionated concentrations from evaporated lakes in the desert 'bolsones,' are almost wholly on the protected faces of cliffs composed of tuffs, tuff-breccia, and porous lava-flows, of acid types. This is no accident. There must be a genetic relation in a condition that recurs so persistently. Mr. Williams attributes the fixation of the nitrogen to certain bacteria, but he is also puzzled by the facts that the phenomenon is absent from cliffs of other classes of rocks, and that ideal conditions for the formation of nitrates on the acid rocks in the region where some are found do not always produce them. He displays hesitation again when he faces the contradiction that the soil at the base of certain cliffs was not abnormally rich in nitrogen, while the bare rock 25 feet higher was impregnated with nitrate salts. It is evident that both the nitrifying and the nitro-fixing bacteria would have found the soil a more congenial residence. It is a bit surprising, considering the ease with which the plate-test can be applied, that geologists have not taken samples and positively settled, once and for all, the question as to the presence of these bacterial organisms on the nitrate-encrusted cliffs. It raises a question whether the bacterial theory, long invoked to explain the Chilean deposits, is not being overworked when it demands a high degree of discrimination on the part of the azotobacter for special kinds of rocks, considering that his colonies flourish so readily in the soil-detritus from any kind of rock that is not wholly deficient in lime to protect him against too much acidity. The observation made by Mr. Williams that the rocks in which the nitrates are formed show unmistakable signs of hydrothermal action is likely to prove significant. In any case secondary silica is quite certain to form as a result of the alteration of the alkaline silicates to provide the bases found in the encrusting salts. It has been suggested that the occluded nitrogen in the original gases accompanying these acid tuffs and lavas may have continued to react, as they are supposed to do in the magma, producing ammonia, which would oxidize to nitric acid, and thus gradually accumulate at the point where evaporation of the capillary flow took place. The question is worthy of further attention because the public will need to be convinced again, for the cheerful promoter will rise superior to these sane warnings of capable geologists, and an explanation that leaves fewer exceptions unexplained will be more conclusive.

The Market-Value of Gold

The Editor:

Sir—As stated in the daily press, the recent conference of gold miners at Reno adopted certain preambles and a resolution of which the following is an extract; "Whereas, * * * the price of gold, as our standard of value, being fixed by law at the invariable figure of $20.6718 per ounce, thus being the only important product which has not obtained an increased market-price due to the present war conditions."

The phraseology of the foregoing extract is somewhat vague, but it seems to mean that, because our Government has passed a law fixing the 'price' of gold invariably at $20.6718 per ounce, its market-value cannot increase, as have the market-values of other important products on account of the present war-conditions.

Assuming that the above extract is substantially correct, it would appear that the framers of the preambles and resolutions were not entirely conversant with the basic principles of money. These principles have been outlined in my previous letters, in your issues of August 3 and 17, but permit me to add the following, with the object of bringing about a better understanding.

Since gold is the standard by which exchange-values are compared, if any product (commodity) increases in 'price' it means that it will require more gold to purchase a given quantity of such product; therefore, as compared with such product, the exchange-value or purchasing power of gold has decreased. To illustrate this, let it be assumed that about four years ago the 'price' of wheat was $1.10 per bushel, which means that a bushel of wheat was exchangeable in the market for 25.542 grains of gold. The price of wheat now, as fixed by the Government, is $2.20 (that is 51.084 gr. of gold) per bushel, hence it takes twice as much gold now to buy a bushel of wheat as it did four years ago; therefore, as compared with wheat, gold has only one-half the purchasing power now that it had four years ago, or, in other words, its exchange-value (market-price) has decreased 50%.

Again, about two years ago copper sold at 32½ cents (7.5465 gr. gold) per pound in the open market; now it sells at 26c. (6.0372 gr. gold) per lb., (the price temporarily fixed by the Government) a decrease of 6.5c. (1.5093 gr. gold) per lb.; hence, the exchange-value or 'market-price' of gold as compared with copper has increased 20% in the last two years, because it requires only 6.0372 gr. of the former to buy a pound of the latter, in place of 7.5465 grains.

These two illustrations will serve to show that, within a comparatively recent period, the market-value of gold has decreased 50% in respect to one commodity and has increased 20% in respect to another. In each instance, the 'price' of the commodity has been 'fixed' by the Government, consequently the Government has diminished the "invariable" market-price of gold 50% as compared with wheat and has increased it 20% as compared with copper, which proves that the "market price" (meaning exchange-value) of gold is not "invariable," as it is stated in the foregoing quotation from the proceedings of the conference at Reno. The only thing about it that is "invariable" is the fact that 20.6718+ times 23.22 gr. is 480 gr., or one Troy ounce; but that fact has nothing whatever to do with the worth, exchange-value, or purchasing power of an ounce or any other quantity of gold.

W. DE L. BENEDICT.

Del Monte, California, August 19.

The Status of Gold Mining

The Editor:

Sir—Owing to the rising cost of machinery, foodstuff, and labor, while the value of their output is fixed, the gold miner in Canada and the United States is facing unprecedented conditions. At no time, says Secretary McAdoo, has the country so much required the largest possible production of gold. Next to food and ammunition, gold is one of the most important war essentials. The United States and Canada have put an embargo on the exportation of gold from their respective countries. How the gold-mining industry is to protect and maintain its production at the maximum point is no longer a local issue; it has become an international matter. Inasmuch as gold is such an important factor in carrying on the War it is the duty of every loyal citizen to help in solving this insistent problem.

I have seen many valuable suggestions for a solution of the question, among which the two most sensible were: first, by an international agreement to increase the price of gold; second, to give a bonus to the gold miners.

The first suggestion, in my opinion, is excellent, but there is the difficulty of receiving the consent of all the powers interested, because such a change in the standard unit might create a disturbance in the world's economic conditions, with far-reaching consequences. And we must include the neutral countries, which trade with the Allies as well as with the Enemy. They would face a considerable difficulty in adjusting a rate of exchange

and a trade-balance if there were a change in the price of gold.

It is true, the gold-mining operators in Canada and the United States are facing a rising cost of raw material and labor, but many a gold-producing country is still enjoying a fair return from its gold-mining industry, some by having cheap labor while others have cheap foodstuffs as well. These countries would prefer the price of gold to remain as it is rather than take the chances of stretching its long-established standard value. The mine-owners of Canada and America are hit the hardest; especially is this true of those in the Yukon and Alaska, where gold mining is a paramount industry and operating expenses are excessively high at all times. These questions, as matters stand, are American and Canadian questions. Because these two countries are mainly supplying war materials to the Allies and feeding those in the trenches, as well as the civilian populations of Europe, the prices at home have gone up to the present unprecedented mark; and industrial activities have been so intensified as to cause a great demand for both skilled and unskilled labor, and farm-hands as well. The shortage of labor and the high wages, with a fixed value for gold, are indeed the greatest handicaps to the gold-mining industry of this country and that of our neighbor.

The second suggestion, that the Government subsidize the gold miners, may be feasible. The purchasing power of gold has declined to half of what it was before the War. It may decline further before hostilities cease and the market returns to its normal condition. It is doubtful whether the Government would subsidize mining investors, as such, so that they would be justified in continuing operations after paying fair wages to the mine-workers. They may consider that they can make more profit to themselves by investing their capital in digging for copper, lead, or some metal other than gold.

Reviewing the situation, I suggest that the gold mines, for the duration of the War at least, should be controlled and operated by the Government. A satisfactory arrangement to the Government and to the mine-owners themselves could be reached and the investor's interest fully protected. While an individual cannot run his mine with loss for long the Government could, if necessary, for the reason that any deficit may be met by a taxation or else it could be balanced against the profit made in the other departments, such as telegraph, customs, railroad, or post-office. That is why I say that the question is now a Government question, and a question, it might be added, requiring an immediate decision. The principal advantages to the Government would be:

1. An abundant gold reserve in the Treasury, to stabilize the national credit.

2. The returned soldiers could be given suitable employment in mining.

Gold mines, it seems to me, ought to be operated by the Government, because the largest portion of the production has been and is being used by the Government. Nearly 80 to 90% of a country's production, it is said, goes to the Government for coinage, while 10 to 20% is used in manufacturing ornaments. This is not true of the other metals.

S. KAWAKAMI.

Dawson, Y. T., August 8.

Formulas for Mine-Valuation

The Editor:

Sir—I have read with interest W. W. Whitton's paper on 'Mine Valuation' which appeared in your issue of May 18 and, while agreeing with him that the Hoskold formula is in error, and that a new one should be adopted for the valuation of mining investments, I do not consider that Mr. Whitton's is constructed on the correct hypothesis to fulfill the purpose. A new one is here suggested, and a short comparison of the three formulas given, with redemption-tables for the typical case cited by Mr. Whitton.

The theory on which the Hoskold formula is based is that the dividend received from a mining investment must be regarded by the investor as being composed of two constant parts, one representing interest on the original investment (at a rate which is considered commensurate with the risk) and the other a return of capital, which latter must be of such amount that, when re-invested at compound interest (security rate), it will equal the amount of the original investment when the mine is exhausted and the dividends cease. Mr. Whitton agrees with the Hoskold theory of separating the dividend into two such parts, but disagrees with Hoskold's method of apportionment, and he considers that the risk-rate of interest should be expected only from the amount of capital remaining unreturned, and that, therefore, the two parts of the dividend should not be constant but varying, the amount of risk-rate interest annually decreasing, and the returns of capital correspondingly increasing in the investor's segregation of dividend. I agree with him up to this point, but believe he is in error in constructing his formula on the assumption that the compound interest on accumulating returned capital is to assist in bringing it up to the amount of the original investment in the stipulated time, and I suggest that it should be so constructed as to bring about that result without the assistance of interest; otherwise the investor places himself in the position of having the whole amount of the original investment tied up while drawing interest on a continually decreasing portion.

The formula here suggested is based on the assumption that the investor, while drawing risk-rate interest on the amount of capital remaining in the original venture, is also entitled to security-rate interest on the portion that is considered to be returned, for it necessarily does not come into his use if it must be set aside as a sinking-fund. By way of illustrating the application of the three formulas in discussion, a comparison of redemption-tables for the typical case cited by Mr. Whitton is appended. The typical case is that of a mine with an expected life of 10 years, paying an annual dividend

of $1000, the rate to be allowed on the investment to be 10%, and the redemption-fund placed at interest at 4%.

Using the same notation:

j = rate at which sinking-fund is to be placed at interest.

i = rate to be realized on the mining investment.

d = amount of annual dividend in dollars.

n = years of life of the mine.

V = present value of the investment.

The formulas are as follows, with values of investment computed from them:

HOSKOLD—

$$V = d\,\frac{(1+j)^n - 1}{(1+j)^n i - i + j} = \$5455.81$$

WHITTON—

$$V = d\,\frac{(1+i+j)^n - 1}{(1+i+j)^n i + j} = \$6591.37$$

NEW—

$$V = d\,\frac{(1+i)^n - 1}{(1+i)^n - i} = \$6144.58$$

The redemption-tables constructed on the above formulas are as follows:

HOSKOLD

Year	V	d	Vi	$(d - Vi)$	Amount in sinking-fund
1	$5455.81	$1000	$545.58	$454.42	$454.42
2	5455.81	1000	545.58	454.42	972.02
3	5455.81	1000	545.58	454.42	1418.52
4	5455.81	1000	545.58	454.42	1929.68
5	5455.81	1000	545.58	454.42	2461.28
6	5455.81	1000	545.58	454.42	3014.15
7	5455.81	1000	545.58	454.42	3589.14
8	5455.81	1000	545.58	454.42	4187.12
9	5455.81	1000	545.58	454.42	4809.03
10	5455.81	1000	545.58	454.42	5455.81

WHITTON

Year	V	d	Vi	$(d - Vi)$	Amount in sinking-fund
1	$6591.37	$1000	$659.14	$340.86	$340.86
2	6250.51	1000	625.05	374.95	729.44
3	5861.93	1000	586.19	413.81	1172.42
4	5418.94	1000	541.89	458.11	1677.43
5	4913.93	1000	491.39	508.61	2253.13
6	4338.22	1000	433.82	566.18	2909.44
7	3681.91	1000	368.19	631.81	3657.62
8	2933.72	1000	293.37	706.63	4510.56
9	2080.78	1000	208.08	791.92	5482.90
10	1108.44	1000	110.84	889.16	6591.37

NEW

Year	V	d	Vi	$(d - Vi)$	Amount in sinking-fund
1	$6144.58	$1000	$614.46	$385.54	$385.54
2	5759.04	1000	575.90	424.10	809.64
3	5334.94	1000	533.49	466.51	1276.15
4	4868.43	1000	484.84	513.16	1789.31
5	4355.27	1000	435.52	564.48	2353.79
6	3790.79	1000	379.08	620.92	2974.71
7	3169.87	1000	316.99	683.01	3657.72
8	2486.86	1000	248.68	751.32	4409.04
9	1735.54	1000	173.55	826.45	5235.49
10	909.09	1000	90.91	909.09	6144.58

An analysis of the redemption-tables above will show the return to the investor to be as follows, under the several formulas:

Year	Hoskold, %	Whitton, %	New, %
1	10	10	10
2	10	9.48	9.62
3	10	8.89	9.21
4	10	8.22	8.75
5	10	7.45	8.24
6	10	6.58	7.70
7	10	5.58	7.09
8	10	4.45	6.43
9	10	3.16	5.69
10	10	1.68	4.89

The Hoskold formula provides for an income at risk-rate each year on the original capital, irrespective of the fact that an annually increasing amount of it has been removed from the venture on which the risk-rate should be paid.

The Whitton formula provides for an income at a risk-rate on the unreturned capital, but no income on the returned capital tied up in the sinking-fund.

The new formula provides for an income at a risk-rate on the unreturned capital and security-rate (or as the investor may elect) on the returned capital, the combined income varying from risk-rate to security-rate according as capital is removed from one class of investment to the other.

In the tables given above for rate of income, it is presumed that the investor under the new formula has reinvested his returned capital at 4%.

D. B. MORKILL.

Hazelton, B. C., June 1.

Flotation and Other Troubles in Mexico

The Editor:

Sir—Appreciating your endeavor to print only correct English, I believe you should be consistent and print pictures that are true to life even though they be advertisements. Like the man that wants to boost your 'Review of Mining' automobile to the top of the hill, I would like to give orders immediately that no more concentrate be left on an open platform as shown in your advertisement of the K & K Flotation Machine Co., on page 24, of the advertisement section in your issue of July 6. This building should be enclosed at once, a 10-ft. stone or adobe wall built around the mill placing broken bottles in mortar at the top. Gun-towers should be placed at the corners and an 'escolta' of at least 20 men. We have done this to our mill and have even installed two K & K machines, yet they are stealing. The picture apparently is supposed to represent a mill in Mexico.

Our company, the Cubo, is operating a 200-ton per day flotation plant (at present treating only about 150 tons per day) with fair success. The ore averages approximately 350 grammes silver with 5 gm. gold. The mill is equipped with 40 stamps, eight No. 2 Deister tables, two 5 by 18-ft. tube-mills, Dorr thickeners, two K & K flotation machines, and two Hynes disc flotation

machines, and a Portland filter. We consume 400 gm. of oil per metric ton: Mexican crude for a 'collector,' plus about 90 cc. No. 350 Pensacola T & T Co.'s pine-oil as a 'frother.' The concentrate assays approximately 10 kg. silver with 190 gm. gold. About 25% of the silver and 45 to 50% of the gold is recovered on the tables before flotation. We are equipped to table-concentrate either before or after flotation, or both before and after. We now believe table-concentration before flotation is the better method. The recovery of the gold is almost complete—say, 95% or better. We have not run long enough to determine the exact figure. I am having a hard time explaining how my actual concentrate shipments show a gold recovery of 101% for the last two months as against the assay of ore to mill-bin. I had insisted that our automatic bin-sample was quite accurate. Gold in tailing is a mere trace. Recovery of the silver is not so good, but our experimental work gives us hopes that it will improve. One of our hindrances is the lack of clean water. We have mine-water containing ferric oxide and iron sulphate; this comes from an old abandoned mine, our own mine-water, which is quite clear, being unavailable. Creek-water at this time of year is a nice bright-yellow. We can take our choice, though both are limited and we have to recover the water. The pulp will not settle in acid mine-water or dirty creek-water. Lime unquestionably interferes with flotation on our ore if added in excess. A small amount of lime apparently is not harmful, it is less harmful at least than dirty solutions. We are using a small amount; solution tests show 10 to 15 gm. CaO per ton as it goes to the flotation machines. If lime goes over 20 gm. CaO per ton, the recovery drops. If the operator goes to sleep and allows the Dorr overflow to run dirty, the recovery drops almost to nothing. Soda-ash added just as the pulp enters flotation machines precipitates the excess lime, forming calcium carbonate and sodium hydroxide. Our best experimental results are obtained in an alkaline solution of sodium hydroxide. The soda-ash undoubtedly helps to some extent, but so far the increase in the silver recovery by its use does not pay. The cost at mine is 20½c. U. S. per kilogramme.

Like most of the Guanajuato companies, we have considerable old filling. Some of this is mixed with our present ore; however, we are gradually getting the old chutes cleaned out and shortly will have only freshly broken ore. Experimental work on the 'fill' ore has not been satisfactory. The small amount in our present output may be interfering with the milling. I find that the ore from certain parts of the mine contains silver chloride; I am now working on this question to see if it be possible to float this mineral by the use of sodium sulphide. Thus even though today we could do slightly better with cyanide, our results are sufficiently satisfactory to warrant us in going ahead with flotation. We can repeat our present work; we have hopes of doing better.

At first we tried to get flotation operators from the States. We have found that their half-baked knowledge, obtained from practice in copper mills, is of more harm than benefit. We prefer a green man. Flotation of silver ores where the flotation ratio or rather concentration ratio is from 40:1 to 50:1 is quite different.

We prefer the Hynes disc machine. The rotor is made of a shaft on which are mounted a hundred perforated discs, 30 in. diam., spaced 1¼ in. apart. The rotor revolves 100 times per minute. The revolving discs tend to agitate the pulp and the perforations carry the air down into the pulp. The froth collects and is removed as in other machines of this type. The Hynes machine is not sensitive to a slight change in the density of the pulp or a change in the oil. It has given very little trouble mechanically.

Operations are all but impossible here now; how we manage to work at all is a question we ourselves could not answer, yet we work along. I often wonder 'if the game is worth the candle'; at best we hope only to about break even. I all but forget at times that I am married and have a family, for I see them so seldom (my home is at Berkeley). I believe it would be better to join the colors, there would be a little glory in being bumped off at least in France, it would be most humiliating to let a pelao have that honor.

I have just received the results of a run we made with a stock of clear water that we succeeded in obtaining. The silver recovery shows a decided improvement, more nearly approaching our experimental work in clean water. This would confirm Mr. Pearce's conclusions, as well as your own as mentioned in the article on 'Flotation of Gold and Silver,' at the Argo. It is better to use fresh water than attempt to recover water from the thickeners. I now consider this our main problem; how I am to get clean water is a question I cannot answer at this moment. Both the mine and creek water are exceptionally dirty at this time of the year (rainy season). Rain-water has entered the mine, washing down various salts and 'muck' from the upper levels.—Vale.

Guanajuato, July 19. BENNETT R. BATES.

SALT is so abundant and so widely distributed in the United States that the industry can meet domestic requirements in spite of unfavorable conditions, according to R. W. Stone of the U. S. Geological Survey. At some plants in 1917 there was shortage of labor, difficulty in obtaining fuel, and an inadequate supply of freight-cars, yet the total production for the country was a notable increase over that of 1916. The salt produced and sold in 1917 was 6,978,177 short tons, valued at $19,940,442, an increase of 9.7% in quantity and 46.1% in value over the production of 1916. Evaporated salt amounted to 2,482,564 tons, in brine 2,890,588 tons, and rock salt 1,605,025 tons. While Michigan leads in output, it is followed closely by New York. Ohio yields half as much as New York. Kansas, California, Texas, and Utah are the other important States. Imports were negligible in 1917, totaling 64,922 tons; while exports were nearly double this quantity.

The Gold Producers' Harvest Will Come When the War Ends

From 'The Annalist', of August 12, 1918

Doctors remark that patients seldom have major and minor diseases at the same time, but when they do fatal results customarily follow the complication. The War is trouble enough, without having price and credit troubles as "added attractions," according to the vaudeville programs. It would make for the world's recovery from its afflictions if it could deal with its troubles in order and postpone what can be postponed.

All the arguments for action in favor of the gold industry regard it as a burden instead of a convenience that there should be a fixed Mint price for gold. They fail to remark that they are under no compulsion to sell to the Mint, and that they do not sell to the Mint as selling usually is understood. Theoretically they receive their metal back again, in coins of certified weight. They often are paid in checks rather than in bullion, but that does not alter the fact that they get from the Mint all that they give to the Mint, less only an inconsiderable Mint charge. The Mint price has nothing to do with the worth of the gold. That is settled now, as it was originally settled in England, by the universal market for all commodities. Gold is worth what it will buy, no more, no less. The worth of gold is fixed by the price of commodities as much as the worth of commodities is fixed by the price of gold. The goods buy the gold, and the gold buys the goods. The market is free even in these war times, and all buyers and sellers fix their own prices for whatever they own, whether goods or gold, subject only to the control which affects goods and gold alike, for reasons independent of the price or value of either goods or gold.

It would make little difference whether the Mint price were doubled or halved. In either case the bargains would be for the weight of gold which passed, and which is certified to all buyers and sellers. The producers of gold get their profit when they spend it, not when they mint it. The alteration of the Mint price would be disturbing generally, without benefit to them. What they want really is an alteration in their favor of the relation of the prices of goods to gold. It is difficult enough to control individual prices. It is practically impossible to control the relation of one price to another. Gold and goods are exchanged around the globe in these days, and the attempt to control the value of gold in international exchange—something quite different from the control of the Mint price—requires control of world conditions.

The point may be illustrated by what is happening in London now. The Mint price of gold in England is unchanged at 85s. an ounce, but the market price for gold as a commodity is 115s. Thus minted coins have a premium worth, and Scotland Yard is busy checking the illegal traffic in sovereigns and eagles. This is a sequel of profiteering by labor. Workers are receiving wages beyond all their experience, and there is a run for jewelry which exhausts the supply of gold, the commodity. A sovereign makes a ring for which jewelers can get half more than the Mint price of the coin, and gold has disappeared.

Before the War strangers were paid gold in England, and checks were paid to those having bank accounts only. Gold then passed from hand to hand, but now the stranger offering gold in London is looked upon with suspicion. The place of gold in circulation has been taken by Treasury paper, resembling either our greenbacks or 'shin-plasters'. Gold is rationed, and the police observe the uses made of it. If our gold producers want more than the Mint price they can hold their goods until the market meets their views of what gold is worth, as in London. The claim of the producers of gold upon the public consideration is the same as that of producers of other commodities. If they supply the thing which is especially wanted an especial price will and should be made for it. But other things are more necessary for war than gold, such as iron, coal, munitions, ships, and so on. The line must be drawn somewhere. Priority cannot be given to everybody, and a special price cannot be made for everything.

The producers approach this point when they argue regarding the universal need of gold as the basis of credit. The argument would be stronger in normal times. While it is true that the production of gold is falling off the bank reserves are increasing faster than the gold production decreases. While the British gold production has been falling some $6,000,000 this year the reserve of the Bank of England has risen $50,000,000. The Bank of France's reserve is 148,000,000 francs larger this year. Our own bank reserves are ample, and the country's stock of gold has been embarrassingly large, exceeding anything in world experience. Even in Germany the gold reserve is larger by 93,000,000 marks, swollen, it is said, by the annexation of Austria's reserves, which are probably next lowest to Russia's.

It is true that while the gold reserves are larger absolutely they are smaller in relation to the credit based upon them. But in times like these there are substitutes for luxuries when there are no substitutes for necessities. Iron is a necessity, and tin or copper another. That is why they are at a premium, commanding a scarcity price, although the production is above all records. But patri-

otism is a good basis for credit in times like these. We have seen 17,000,000 Americans subscribe for Liberty bonds at a price above the rate for credit ex patriotism, and take their loss proudly and smilingly. That is why there is strong expectation that 34,000,000 will take larger amounts at the next offering, regardless of the loss to the 17,000,000. Redemption of plighted faith is the explanation of the placidity of Englishmen under paper money circulation and a bank reserve alarming under normal conditions. France is under pillage by descendants of the execrated Huns for the second time in modern history, Germany's present demand being for the other half of the iron deposits which it left on a mistaken report of its men of science and ironmasters after the Franco-Prussian war.

There is a double reason for drawing the contrast between France's need and neglect of gold and Germany's desperate search for it in individual pockets and tills. France is an investing nation. Germany is a manufacturing and trading nation. France saves money and accumulates capital put at the use of others for interest. Germany 'makes' money by mercantile profits great in contrast to the narrow reward which satisfies French thrift and patient accumulation. When peace shall return England, France, and the United States will supply themselves with all the gold they need, either by economies, or production, or trade. It is different with Germany. She must buy her gold, for she is too poor a country to save it, even if the Germans were a saving rather than a pillaging people.

After the War there will be a demand among the Teutonic Allies which will sop up all the billions of gold which can be produced on earth. That will be the time of ancient profit for all the gold-producing and gold-owning nations. Germany must be supplied with gold least of all for the sake of Germany or the Germans. They have forced the world into indifference to the sufferings they have brought upon themselves. Germans have passed upon themselves a special renewal of the Divine sentence that in the sweat of their brows they shall earn the fine which is the penalty of their immoralities. The world was a beehive of industry which the Germans overturned, and destroyed the bees for the sake of the honey. In the future the Germans shall be the bees to which the civilized world must feed gold in order that they may make the honey which the world shall garner until Germans have earned the right to be admitted to terms of equality in trade with honest men.

No one has calculated, or perhaps can calculate, the gold which it will be necessary to supply to the Teutonic Allies in order that they may work out their own salvation. The rehabilitation of Germany's destroyed industry and trade will sop up gold like water on sand. The gold must be supplied or Germans cannot work for the world. Naturally Germany cannot get gold for nothing. She must purchase it with cheap goods, and the degree of cheapness will be decided by the owners of gold. If this war has taught anything it has taught that what men want is "goods and services," and that gold is wanted only to command them. Germany's debt to the world cannot be paid in gold, for she has it not. It must be paid in goods and services, or otherwise the world will be poorer and Germans must starve.

The demand for an economic boycott of Germany means that the world should deny itself the cheap goods which Germany can produce better than other people. No man ever thought he was ruined individually by cheap goods, but entire nations have been taught that they were in danger of ruin by being 'flooded' with cheap products. In like manner the gold producers think that the source of their troubles is the cheapness of gold, which does not now produce for them the goods and services which they want in accustomed plenty. What they really need is access to the best market for gold in the world. When the freedom of the seas is restored they can sell their gold to Germans for goods and services which will reduce the world's cost of living.

The Kaiser vaunted that Germany had abolished international law, whereas in fact international law with a sanction dates from the invasion of Belgium. If international law is established on the basis of the common law of all peoples, including the Germans among themselves, then there is an end to the uneconomic cheapness for German goods, made from stolen materials and sold in unfair competition. German goods will not be too cheap, for they must include the cost of what goes into them. That is the meaning of this war for raw materials. They must be bought hereafter by everybody. That is the moral interpretation of Belgium's glorious vicarious sacrifice. When Germany sold its soul for profit, England redeemed its soul at the cost of millions of men and billions of pounds. France fought for the world as well as for itself during all these four years when the blood which has drenched her soil has been spent that American blood need not be shed on American soil.

For three years we coined billions of money out of the agony of our allies, while we were making up our minds about the morality of the issue on which we prided ourselves in being neutrals. If we are to retain a shred of honest pride it can be only by generosity toward those whose ideas of honest trade and profit are the same as ours, and by that justice which will fall hardly short of just severity toward the accomplices of the Kaiser. Every German who has contributed to the German debt is a partner in the Kaiser's blood-guiltiness and plot to take the goods of neighbors even by wholesale murder. Germany's least penalty should be that her national debt shall be a first mortage to pay her fine under international law. Never was a debt floated for such objects before, according to the boasts and confessions of Germans of highest degree.

Germany must sweat goods to repay the sweat of blood by others, and incidentally to give to gold producers of all lands their accustomed command over other goods. There is no need of gold reserves for that object. To that we have pledged all that we have and all that we are. Meanwhile bank reserves and profits to producers of anything are "postponed," in the word of our President.

Chromite

By J. C. WILLIAMS

*The most important foreign deposits are those of New Caledonia, Turkey, and Rhodesia. In addition chromite is mined in small quantities in Russia, India, Australia, Greece, Canada, and Newfoundland. All foreign deposits occur as irregular masses, or pockets, similar to the deposits in California, so that mining and treatment methods similar to those used abroad can be used here.

When it is realized that in 1916 the imports of chrome ore amounted to 114,655 long tons, the importance of domestic sources becomes apparent. In 1913 the output in the United States was 244 tons; in 1916, about 47,000 tons; and the 1917 output is estimated to have been 41,000 tons. The yearly requirements are more than 150,000 tons. The most valuable deposits of chrome ore in the United States occur in California, Oregon, Maryland, Pennsylvania, North Carolina, and Alaska. The greatest part of the country's supply is on the Pacific Coast and the greatest demand on the Atlantic. Transcontinental transportation from the producers to the consumers is, therefore, a large problem in itself. It must be borne in mind, when noting the increase of domestic production from 1913 to 1917, that the ore that has been extracted came from localities which have been well known for a number of years and which were easily accessible. The future production must come, to a large extent, from places difficult of access with probably a long haul to a railroad. Possibly some output may come from small or low-grade deposits, in spite of the fact that the final cost of the product will be greater than that of material from deposits of a more favorable nature.

In the United States chromite in commercial quantities was first discovered by Isaac Tyson, Jr., near Baltimore, Maryland, in 1827. The story of the discovery and development forms a most interesting chapter in the history of American mining. Tyson had become interested in the recently discovered element chromium and at that time was probably the only man in America who possessed the knowledge necessary to make use of his discovery. He one day noticed a farmer driving a wagon in which were barrels kept from rolling by blocks of heavy black ore. These he determined to be chromite. He found the locality from which they came and acquired chromite-bearing ground. He studied these deposits and came to the conclusion that chromite would be found only with serpentine, a line of reasoning that enabled him to discover chromite in other localities. From 1828 to 1850 the district near Baltimore supplied most of the chrome ore consumed by the world. The manufacture of chrome yellow was started there in 1828. The export trade from Baltimore came to an end about 1860 on account of the development of the larger and richer Turkish deposits.

The demand for chrome ore arises chiefly from its use in making alloys, such as ferro-chrome and the like, used in manufacturing steel for projectiles, for armor plate, and for cutting tools; in making refractory chrome brick and furnace-lining; in chemical industries for the production of many colors and dyes; and in tanning. Its application for these purposes is increasing and the demand for it is steadily growing. On account of its great heat-resisting qualities chromite is used as a neutral refractory lining for furnaces. It is either made up into bricks with various binders, or lumps of the ore are packed in tight to make a solid lining. Chromite has two valuable qualities for these purposes: it stands change of temperature well and also resists strongly the action of molten metals. For refractories an ore containing 38 to 45% of chromic oxide can be used. The most important use, however, is for making ferro-chrome.

The word 'chromium' is derived from the Greek word meaning color, on account of the wide range in color of various salts of chromium. Chromium also forms the coloring matter of several minerals; the green color of the emerald is due to chromium. Metallic chromium is not known to occur in the native state. According to Roscoe and Schorlemmer, metallic chrome forms a light green glistening powder which exhibits, under the microscope, aggregations of crystals of a tin-white color, with a specific gravity of 6.81. The fused metal is usually as hard and tough as corundum, melts at a higher temperature than platinum, is not magnetic, and, when ignited in the air, is only slowly oxidized. Heated in the oxy-hydrogen flame it burns brightly, with emission of sparks, and when fused with saltpetre or potassium chlorate, it is converted into potassium chromate. Pure chromium was obtained in 1894 by Moissan, by reducing the oxide with carbon in the electric furnace. It is most easily prepared in small quantities by the aluminothermic process, which consists of reducing the oxide with aluminum powder. Metallic chromium made by this process is used to the extent of several hundred tons per year in the manufacture of high-speed tool steel, as some manufacturers prefer to add their chromium this way rather than as ferro-chrome.

The principal alloy of chromium is ferro-chrome; the alloy of chromium and iron, which contains usually 60 to 70% chromium. It is now produced in the electric furnace from high-grade ores. Other alloys of more than scientific interest are chromium with nickel, cobalt, molybdenum, tungsten, manganese, copper, or vanadium, as well as different combinations of two or three of these elements. One of these alloys is called 'stellite,' and is composed of cobalt, chromium, tungsten, and molyb-

*Abstract from circular issued by the Colorado School of Mines.

denum. It was developed by Elwood Haynes of Kokomo, Indiana. Two desirable qualities of this alloy are its resistance to corrosion and its ability to take and hold an edge equal to that of the best steel. It may be used for table-knife blades, pocket cutlery, surgical instruments, dental instruments, small evaporating dishes, spoons, forks, or scissors.

Chromium is added to steel in the form of ferro-chrome or as metallic chromium. This steel is particularly adapted for making armor-piercing projectiles, on account of its hardness and also its very high elastic limit. It is also used for armor-plate for the same reasons, for parts of crushing-machinery, and for very hard steel plate. It is extremely hard, tough, and dense, and possesses great tensile strength. It is especially adapted to severe service and where resistance to abrasion is desired. For the wearing parts of stamp-mills, such as battery shoes and dies, cams, and tappets, chrome-steel has proved to be the most durable and economical material obtainable. Chrome-steel in some respects resembles the higher grades of tool-steel, but in addition possesses properties combined in no other known steel. It can be made so hard as to be drill-proof against the finest tools. These qualities are taken advantage of in the manufacture of burglar-proof safes and jail-bars, built up of alternate layers of iron and chrome-steel, which cannot be cut or broken. Armor-plate contains about 2% chromium and a certain quantity of nickel. Some steels have been made that contain as much as 20% chromium which have unusual qualities.

Although a number of minerals contain chromium, virtually only one—chrome-iron ore or chromite—is a commercial source of chromium. However, it is of interest to note that the discovery of the element chromium was made by investigation of the mineral crocoite (lead chromate). The discovery was made by Vaquelin, a French chemist, in 1797.

Chromite is isometric. Massive, fine granular to compact. Fracture uneven. Brittle. Hardness, 5.5. Specific gravity, 4.32 to 4.57. Lustre, submetallic to metallic. Color, iron-black to brownish-black, sometimes yellowish-red in thin sections. Streak brown. Translucent to opaque. Sometimes feebly magnetic. Composition, $FeCr_2O_4$ or $FeO \cdot Cr_2O_3$ = chromium oxide 68%, iron protoxide 32%. Infusible before the blowpipe in oxidizing flame; in the reducing flame it is slightly rounded on edges and becomes magnetic. With borax and salt of phosphorus it gives beads which, while hot, show only a reaction for iron, but on cooling become chrome green; the green color is heightened by fusion on charcoal with metallic tin. It is not acted on readily by acids, but is decomposed by fusion with potassium or sodium bi-sulphate.

Chromite is a common constituent of basic intrusive rocks, such as pendotites and pyroxenites, and especially of serpentine derived from them. All of the commercial bodies of chromite occur in these rocks. In place it is always found in association with serpentine, which has resulted from the alteration of basic rocks consisting of olivine, hornblende, and pyroxene. In these the percentage of chromium may vary from 0.05 to 0.5. Chrome is by no means an important element in the earth's crust. The average given by F. W. Clarke is 0.033%. Although it occurs usually in basic igneous rocks, it is sometimes found in titaniferous iron ores to the extent of several percentages. It is rarely associated with other metallic minerals, except possibly magnetic and nickel minerals. The common form of occurrence is as rounded grains or more often massive granular bodies, which resemble magnetite and have sometimes been confused with it, but differ from it in being at the most feebly magnetic. It is a most resistant mineral to weathering. For this reason it is often found in unconsolidated materials such as clay, or in stream materials derived from rocks by erosion. In the weathering of serpentine the more resistant chromite will be concentrated on or near the surface and be misleading as to the richness of the deposit below. Placer deposits of chromite are found where the minerals most resistant to weathering have been concentrated in stream channels, and where these drain areas of serpentine or basic igneous rocks. Along the Pacific Coast there are placers in stream beds and beach deposits that carry, besides chromite, resistant minerals such as gold, platinum, and garnet. The pockety nature of chromite deposits makes the mining very uncertain. There may be one or more of these pockets or lenses scattered through the deposit, but they are not regular.

The production of a high-grade chrome concentrate may be made in two ways: (1) by hand-cobbing, (2) by mechanical concentration. Hand-sorting is generally practised in mining the ore, by means of which a high-grade product may be made without the losses attendant upon crushing and milling. In milling chromite the general practice is to crush in Blake crushers and then by stamps. The crushed ore is treated by classifiers and fed to tables of the Wilfley type. For deposits such as beach sands, which contain, besides chromite, many minerals with different degrees of magnetic permeability, magnetic treatment is a practical solution of the concentration problem. In general it may be said that a concentrate containing 45% of chromic oxide is sought, as material of this grade finds a ready market at satisfactory prices. In Canada ore containing as little as 10% chromic oxide has been successfully treated.

Characteristic features of chromite, by which it may be recognized: Lustre: vitreous, splendent to metallic or sub-metallic. Streak: dark brown. Infusible before the blowpipe but may fuse slightly in the reducing flame and then becomes magnetic. Usually associated with serpentine. Each grain shows a very smooth conchoidal fracture with high lustre.

MANGANIFEROUS-IRON ore occurs in large quantities in the northern part of the Cuyuna range of Minnesota. Seven deposits average 230,000 tons each, eight contain 196,000 tons each, and six contain 1,550,000 each. These contain 10% Mn. Under 10% there are nine with 530,000 tons each.

Another Letter From the Front

Somewhere in France, July 20, 1918.

About an hour after mailing my last letter to you, I received an order attaching me for duty to the famous Guards division of the British army. I have been with them until yesterday, when I returned here, where I am to be for about three months attending the General Staff College.

I hardly know how to begin to tell you of my experience with the Guards. It all seems so like a fairy tale. The mere fact that of all the divisions in the British army I should draw the Guards is a wonderful bit of luck in itself. Within a very few hours after receiving my order, I was on my way, and though I had what we would consider a relatively short distance to go, it took me nearly 36 hours to get there (it should have taken about six), but traveling in the actual war-zone is very slow, unless one is moving with troops. However, the journey was intensely interesting, because it was through a part of France where some of the most furiously fought battles of the War have taken place. A British brigadier who had fought all over that section was traveling in the compartment with me, and he fortunately was willing to talk, and gave me most interesting information about what had taken place, and how the tide of battle had ebbed and flowed over the very ground we were slowly proceeding across. Oh, the desolation and wanton destruction! It can't be described. One wanted to weep and swear at the same time—it is so pathetic and so hellish. As a result, every time I saw a Boche (and I did see hundreds of them, thank God) I wanted to kick him in the face if he had any left—many of them didn't—or violate his infernal carcass in some other way. Really, you cannot actually hate until you have been through this thing, and for your own sake I hope you never will, for it puts a streak of iron in one's soul that civilized human beings should never have. There is a bitterness engendered in man that must have an unpleasant and everlasting influence upon my life, no matter how short or how long that life may last. But I must not dwell on that. By the time I had reached my destination I had received a first-hand impression and understanding of the War as it has been, and as it is, far more vivid than I ever hoped or expected to have.

Upon reporting to the Chief of Staff, I was cordially received, and it being about lunch time, I was taken to the Major-General's mess, of which I was to be a guest while at division headquarters. Well, I wish you could have seen that meal, or more properly, could have eaten it. Instantly I thought of you and our mess at McAllen—it was so damned different. There we were within artillery fire of the German front line, we could distinctly hear the roar of the guns, yet the meal served and the manner of serving it would compare quite favorably with M's best effort, and that is going some. But this is not a panegyric on food. I merely mention it to show how wonderfully they do things after four years of hellish war. The Major-General is a man whose name you would recognize at once, but I must not mention it. He has a string of initials a yard long after his name, but be seemed really interested in questioning me about myself, our army and what they expected of us, and altogether was perfectly charming. He directed his A. D. C. personally to see to my billet and that of my 'servant,' and this suggests a subject about which one could write at length, for the servants in the British army are real artists. The one assigned to me was named Macgregor, so you can judge which one of the Guard regiments he came from. He was a wonder, and seemed to anticipate my every wish. Wherever I went to spend the night, even in the front line, he went too, packed and unpacked my stuff, and saw to its transportation. Ye gods! what luxury not to have to depend upon a 'detail' whose fingers are all thumbs, to do such things, and then finally have to do it oneself. I was to have the billet of a colonel who was going on leave, the next day after my arrival, so, after many apologies, I had to occupy for one night a heap of debris that had once been a fine room, but a 12-inch shell had taken a few liberties with it, and about the only accommodation it offered was protection against rain, provided it came down straight and not too hard. It was cold as blazes, but my man made me quite comfortable for the night. Next morning, however, it was hell. I heard him fussing around about 7:30 and watched, when he was not looking, to see what he was doing. Imagine my horror when I saw him bring in a large collapsible tub and start to fill it with water. Ugh! finally, after much formality, he informed me "Your bath is ready, Sir," and there was nothing for me to do but get up and stand in the damned thing while he poured petrol-tins full of water over me. Really, I deserve the V. C. for that, yet I would rather have been shot on the spot than to have hesitated, for Macgregor would have considered himself disgraced for life if 'my officer' had shown himself to be such a weakling. No matter what the future has in store for me, it cannot be more trying than that bath or require more courage to face. Macgregor decided what I should wear, made me change my clothes for dinner every night, even in a front-line dug-out, and in about two days had all my leather stuff so I could see my face in it. They are great sticklers for that, as you probably know, and although the mud in the trenches outside was knee-deep, you were expected to have immaculate boots when you first stepped into it upon leaving your dug-out. Of course the Guards are noted for their 'swank,' but it seems incredible that they could carry it so far, and how it does make for discipline! Our ideas are really absurd, compared to the perfection to which they have developed it. I never believed such soldiering was possible, and

with it all there is the most wonderful camaraderie between all ranks. Each officer is called by his first name, or more commonly by some queer nickname, that is, all except the General Officers and C. Os. The consideration shown to the enlisted men by the officers surprised me most of all; there is always an unbridgeable gulf, yet no one had too much rank to say "Thank you' and 'If you please.'

After two days at division headquarters, studying the tactical position, I went to the front line and spent 36 hours in a company headquarters, then two days and nights at battalion headquarters, finally getting back to brigade headquarters for three days and nights. The distance from the Boche front line ranged from 40 yards, while in the front line, to about 1000 yards when in the brigade headquarters. All the time, of course, I was living in various dug-outs. I expected to find things a bit rougher when I left division headquarters to go nearer the front, but not at all. The same delightful formality prevailed, and the dinner I had within fifty yards of the Hun line consisted of five courses, beautifully cooked and served, with Scoth, port, three liquers, and beer to select from. I had my tub and shaved every morning, polished boots, and clothes cleaned of all vestige of mud awaiting me. Now, don't think I am romancing in the least. I know it seems impossible, but upon my word, I really am moderating my description for fear you may think I am just lying. The answer is simply this: these chaps have been in this war so long that it has become a matter of routine with them. Their sirvice of supply is the most wonderful organization I have ever seen. Nothing is ever late in arriving, and there is no scarcity, but no waste. Every man has his job, does it, and never knocks the other fellow. The Brigade Commander, with whom I spent three days, is a lord—has the V. C., D. S. O., and numerous other initials after his name—yet if some of our people should see him dawdling over his dinner and sipping his port afterward, wearing a monocle the while, they might think he was a typical silly-ass stage Englishman; but believe me, folks, that chap is the real thing in the soldier game. I unhesitatingly admit that during the first few days of my stay in the trenches, I was scared green, and any man who says he isn't is a liar. No trench or dug-out seemed deep enough to suit me during those first few days, and when on the second day the Boche dropped a 'minnie' that must have been as large as the dome on the capitol at Washington plunk into the trench about thirty yards from me, and the dirt and stones began to rattle down like hail on my tin hat, I was quite ready to call off the war right there and return to the Armory warfare of Thursday-night drills, where the most dangerous thing is one of Tom Anderson's delayed-action fuse sub-calibre cartridges down in the range. However, one has to get used to such things, and in a few days, I was walking about the trenches, standing up to the full height of my 68 inches.

A little bit of everything happened while I was there. I now know what it is to go 'over the top,' stumble over a dead Boche, and fall into a mass of barbed wire. I have been sniped at, a target for machine-guns, and helped dig up one poor fellow from a shell-crater whose entire body below his chest was blown away. One of my prize possessions is a Boche bullet that knocked my stick from my hand, but did no further damage. The infernal thing is dum-dumed too, as I shall show you if I have the good fortune ever to be back. A new trench-coat that I bought in Paris just a few days before was so badly eaten up by the liquid from a gas-shell that exploded near me that I had to throw the thing away. They also pulled off a raid while I was in the line and brought back three Huns. Only one man of the raiding party was hurt. They brought him back, as they always do, but I fear the poor chap has died, as he was shot through the stomach.

I know that all this seems like fiction, but every word of it is true, for one cannot exaggerate anything about this war. Thousands of similar things are happening to thousands of men up there every day, but no one thinks anything about it. It is quite as natural to them as is your daily routine at home to you, or anyone else. Of course, happening to me, some one you know, it may seem impossible, but unfortunately it is not. We have just such things ahead of us for our daily routine until this hellish war is over.

My work here is to be intensely interesting, and by all odds the most difficult I have ever attempted. The class consists of 116 officers, with a great preponderance of colonels and lieutenant-colonels. I am the only National Guard officer in my section, and as about only one in five of the previous class qualified, you can imagine what I have ahead of me. Unfortunately, there is a strong prejudice against N. G. officers, which makes it just that much harder for me, but the goal I have set for myself is to be among the first ten at the finish, prejudice or no prejudice, for that is the honor group, and Company I would never stand for a piker.

The town here is wonderfully interesting, one of the oldest in France and more closely associated with early Roman history than the French. When I was struggling through Caesar's 'Commentaries,' I was trying to read a lot about this place and its associations with his humorous scraps with the Gauls. God knows, I hope I make a better showing in my present studies than I did then, for I never could get Latin through my head.

DECOMPOSITION of refractory minerals containing alkali metal and aluminum is effected by a process patented (Can. 183,238) by W. H. Swenarton, as follows: Finely ground feldspar is intimately mixed with an equivalent of K_2CO_3 and fused at 800 to 1200° C. for about one hour. The mass is removed from the furnace, ground, and digested with approximately 10 volumes of water, and then filtered. The precipitate is boiled with concentrated H_2SO_4 or HCl, and neutralized with alkali to precipitate the Al_2O_3 and the SiO_2. The filtrate is boiled to precipitate the K or the surplus K may be removed by neutralizing with $Al_2(SO_4)_3$ or with potassium-alum until the solution is slightly acidified.

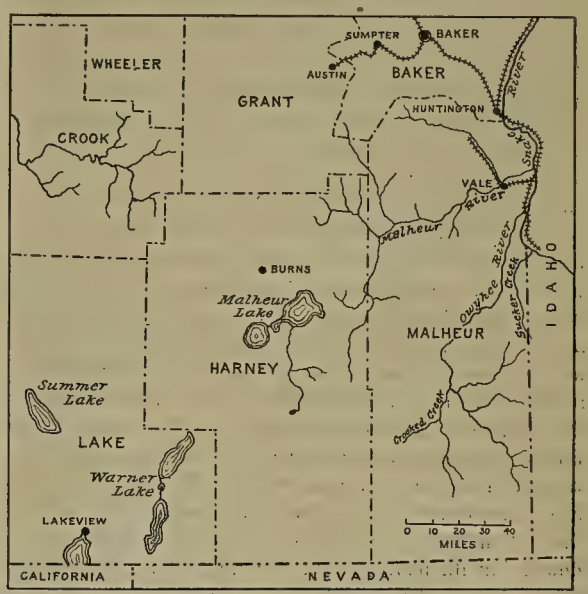
Nitrate Deposits of South-Eastern Oregon

By IRA A. WILLIAMS

The first announced discovery of nitrates in south-eastern Oregon was on Sucker creek, Malheur county, on the Snake river a few miles across the line in Idaho. Nitrate salts were recognized there in 1914, and also on Jump creek south of Homedale. The publicity given to this discovery led to a wide search for nitrates in all parts of the semi-arid portions of Oregon. Throughout the succeeding three and one-half years a large number of nitrate showings were found scattered from Deschutes county through all of the three largest counties of the State, Lake, Harney, and Malheur. Certain features are common to practically all the deposits so far examined in that region. One feature is that they are associated with the more acid types of volcanic rocks, namely, rhyolite, rhyolite tuff, and silicified rhyolite and tuff. Not a single verified instance is on record of the finding of nitrates in connection with the basaltic flows that cover enormous areas in this portion of Oregon. A second feature is that the prevailing nitrate compounds recognized in these deposits are both sodium or Chile saltpetre ($NaNO_3$), and potassium nitrate (KNO_3) or common saltpetre, and occasionally small amounts of calcium nitrate ($Ca(NO_3)_2$), or of the similar compound of magnesium. Rarely do these salts exist alone, or even constitute the main proportion of a deposit; they are accompanied everywhere by one or more of the following substances: sulphates of sodium (Na_2SO_4), of magnesium ($MgSO_4$), and less frequently sulphates of aluminum and of lime. Common alum is sometimes present; chloride of sodium and of potassium; carbonates of sodium, and lesser amounts of magnesium and calcium carbonates. The salts are frequently stained with iron compounds. A third point of resemblance among the various occurrences is the position in which they are found. With rare exceptions, all are found in the walls, roofs, or floors either of open caverns, or in partly protected crevices or other recesses in the rocks, as incrustations or coatings on the surface, as disseminated crystals or crystalline masses in the dust, rock-scale, or talus, and organic matter, which compose the floor of the caves, and in the pores, cells, and vesicles of the rock adjacent to such openings. In the majority of instances there is evidence that animals, birds, or reptiles either have inhabited, or at the present time make use of, the chambers in or near which the nitrate salts are found.

The following localities were visited in the course of my work during two seasons:

Sucker Creek. Following the discovery of nitrates here in 1914, G. R. Mansfield of the U. S. Geological Survey visited the locality and has described the deposits in Bulletin 620-B. Much of the course of Sucker creek is cut in the Eocene lake-beds, which consist generally of sandy clays, volcanic tuffs, some conglomerates, and sandstones. The lake-beds are interbedded with and overlie rhyolitic lavas, through which Sucker creek has trenched a deep rugged canyon. It is in and associated with the rhyolite that the nitrates occur. In texture, the rhyolite is dense to vesicular, and the rhyolitic tuffs vary from compact to ashy and porous. The nitrates and other soluble salts appear more frequently in the open-textured varieties. A notable feature of both tuff and lava is the generally constant presence of secondary



SOUTH-EASTERN OREGON, IN WHICH ARE NITRATE DEPOSITS

silica in the pores and cells, and in the lining of the crevices. Much of the silica is opal and agate and obviously marks a period of hydrothermal action. In 1915 and 1916 an organization known as the American Nitrate Co. undertook to prospect and exploit a group of claims on Sage and Sucker creeks. Experimental leaching vats and an evaporating plant were constructed, and an effort was made to determine the quantity and distribution of the salts, and the feasibility of extracting and refining them on a commercial scale. My samples, taken in 1916 from various openings made by this company, were tested qualitatively in the field by E. G. Stowell of the U. S. Bureau of Mines. The tests demonstrated the existence of a mixture of soluble salts in every exposure, sometimes, however, being scarcely a trace. Chlorides and sulphates were uniformly present, the bases being sodium, potassium, calcium, magnesium, and aluminum. Some of the best showings were in the outcropping slopes

of a bed of ashy shale-clay to the north of Sage creek. It was here that the leaching plant was installed with the intention of working the outer 12 to 18 inches of the sandy clays for the nitrate salts. The results of the quantitative analysis of an average surface sample from this slope is as follows:

	%		%
SO_3	0.40	Potash (K_2O)	0.30
Chlorine	0.52	Soda (Na_2O)	1.00
Calcium	0.41	N_2O_5	0.69

The above constituents represent a combined total of soluble salts of somewhat more than 3% of the sample. Operations were continued by this company for some months, and finally abandoned. In all instances, where tunnels were driven into the tuff or rhyolite, starting at points where nitrates were exposed at the surface, the quantity was found to diminish rapidly to a trace or to absolute disappearance.

Owyhee River. In northern Malheur county, deposits of nitrate salts have been found at a number of points in the canyon of the Owyhee river both above and below the Watson post-office. The salts appear at the base of a vertical cliff of rhyolite and rhyolitic tuff probably 100 ft. high, facing north. The salts are found at the head of a talus, 130 ft. above the river. The tuff is porous, pebbly, in places open-textured, and even soft and friable. For a distance of 100 to 150 ft. along the face, and for several feet above the upper border of the talus, every protected re-entrant, and particularly the walls of a series of under-cut caverns, are heavily coated with a whitish efflorescence of what proved to be chiefly sodium nitrate. The salts are also mixed with the dirt and organic matter in the floors of the caverns, and a series of open-cuts in the talus proves, according to J. H. Matthews, that the nitrate is quite generally distributed throughout a large body of material. The penetration of the salts into the rock of the cliff has not yet been ascertained. The favorable position of the rock face, at the base of which the nitrate occurs, accounts no doubt for its having been a rendezvous for stock for many years and for wild animals and birds indefinitely. The surface showings of soluble salts, which are prevailingly nitrate, are the most conspicuous and abundant of any prospect I have seen in south-eastern Oregon. This property is known as the Hercules claim. Similar exposures at intervals farther up the river are reported. Five or six miles down the Owyhee from Watson is the Stickney group of claims along the west side of the river. Here, as before, the salts appear at the foot of the cliffs at the upper limit of the talus in both rhyolite and rhyolitic tuff. It is notable, however, that, instead of nitrates being universally present, some exposures are practically free from these compounds. For example, at the slightly under-cut base of a cliff of hard jointed rhyolite, with a southern exposure, the loose broken detritus that has scaled from the rock is in places bound together by intercrystallization of a fibrous mass mainly consisting of magnesium sulphate (epsom salt). Sulphates predominate to the practical exclusion of nitrates. Above the border of the talus, for a few feet, in the exposed and scaling rock, only the less soluble calcium sulphate (selenite or gypsum) is present. No organic matter is in evidence in this exposure. One-half mile to the southward the salts occur in the dirt and talus for a few hundred feet along the under-cut base of a sharp cliff or inclined beds of buff, pebbly, volcanic tuff. Here, again, sulphates predominate, the main compound being sodium sulphate (glauber salt), with only a minor proportion of other non-nitrogenous salts. No systematic prospecting has been done. Thirteen miles west of Vale are claims held by Matthews Bros. of Twin Falls, Idaho. The lake-beds are deeply dissected by side gulches and water-courses leading into the valley of Malheur river. The showing of soluble salts appears at intervals along the outcropping edge of a 5-ft. bed of pebbly tuff or fine-grained conglomerate. The stratum rests upon a well-cemented boulder-conglomerate, and is covered by tuff and possibly by inter-bedded lava in places. The salts are on the western exposures and in under-cut portions of the bed. A sample of the richest material gave distinct reactions for sulphates, chlorides, or nitrates. The bases recognized were sodium, calcium, and magnesium, and less decisively, potassium.

Duncan Bridge. Samples containing supposed nitrates from near Duncan bridge on the Owyhee, Malheur county, were submitted to the Bureau in 1916 by W. P. Keady of Portland. Chemical analyses of four samples gave the following results:

Sample 1

	%
Insoluble (largely silica and alumina)	14.7
Sodium bicarbonate ($NaHCO_3$)	20.34
Sodium sulphate (Na_2SO_4)	18.73
Sodium carbonate (Na_2CO_3)	2.54
Potassium nitrate (KNO_3)	0.45
Sodium chloride (NaCl)	40.24

Sample 2

	%
Insoluble	16.50
Sodium bicarbonate	18.54
Sodium sulphate	20.20
Sodium carbonate	1.50
Sodium chloride	40.80
Potassium nitrate	1.34

Sample 3

	%
Insoluble	25.60
Sodium chloride	44.87
Sodium sulphate	27.84
Potassium nitrate	0.97

Sample 4

	%
Insoluble	18.97
Sodium sulphate	34.76
Sodium chloride	43.16
Potassium nitrate	1.43

In the vicinity of Duncan bridge about 300 ft. of the lake-beds are overlain by 15 to 25 ft. of more recent basalt, separated from the former by 15 ft. of gravel and sand. Two miles below the bridge, the uneven surface of the underlying silicified rhyolite appears and rises down-stream, so that the sedimentary lake-beds are shortly displaced entirely by the lava. The canyon of Crooked creek is a gash cut through the lake-beds into the rhyolite. Small showings of nitrates are found in a few protected places in the north wall of this canyon just above its embouchure into the Owyhee. The salts here are in the cells and vesicles of the lava, and in places as a coating in cracks, and in the rock detritus of the floors of under-cut recesses at the bases of cliffs that face

south. The showings here are quite inconspicuous, and to the taste there is present always a large proportion of common salt (NaCl) and of ordinary sodium-bicarbonate. Chemical tests by G. E. Stowell of a series of samples of both salts and of the parent rock demonstrated the presence of both potash and soda nitrates in three out of five. Epsom and glauber salts, soda, common salt, and some alum were found in the various samples.

McDermott. L. R. Hagler submitted samples of soluble salts said to have come from a locality close to the Oregon-Nevada line. Tests showed that they contained both potassium and sodium nitrate. A visit to this locality proved that the sample came from altered silicified rhyolite, a great thickness of which appears to occupy a considerable area eastward from McDermott. This rock, as exposed along Rock creek, one of the head-feeders of the north fork of Quinn river, weathers in places into conspicuous domes, pillars, and jagged cavernous crags projecting from the canyon wall. It is in one of these, 200 ft. above the stream in the east wall of the gorge of Rock creek, that the nitrates occur. The group of crags in which the salts are found is a contorted cavernous and scoriaceous rhyolite, obviously inhabited by both animal and bird life, as attested by the presence of guano. The salts in small quantity coat the sides and top, here and there fill in the seams, and also permeate the soils in the floor of numerous small caverns.

Rawhide Gulch. The American Nitrate Co., with holdings both in Sucker creek, Malheur county, and at Wagontire mountain, Lake county, prospected also in the gulch of Rawhide creek, which is cut through rather flat-lying acid lavas and tuffs, and is rarely more than 75 to 150 ft. deep. For several miles there are indications of nitrates along a nearly continuous rim of fairly hard, pink, rhyolitic tuff-breccia. As elsewhere, the salts are in crevices, and in the linings and floors of caves, undercut recesses, and other protected re-entrants in the faces of ledges and cliffs. They are found also to an almost unexpected extent within the pores of the rock itself, in proximity to places where coatings appear. The salts are potassium and sodium nitrates, accompanied always by sodium bicarbonate and common salt, and occasionally by alum. In the opening where nitrates are found there is almost universal evidence of the presence of animal and bird-life. The quantitative analysis of the salts from a sample of the rock in Rawhide gulch, broken from a freshly blasted face, where surface showings are favorable, gave the following results:

	%		%
Nitrogen pentoxide (N_2O_5)	0.16	Lime (CaO)	0.27
Potash (K_2O)	0.12	Chlorine	0.88
Alumina (Al_2O_3)	0.21	Sulphur trioxide (SO_3)	0.24

Similar nitrate showings were prospected by this company in Buzzard gulch 15 to 18 miles north-east from Rawhide. The salts are found here for a few miles mostly in a soft, rhyolitic, tuff-breccia. On account of variations in its character, cavernous masses of the tuff protrude from the canyon wall in places, and these seem to have been favorable positions for the soluble salts to accumulate. They are not limited to these positions, however. Exposed faces of the tuff exhibit a sort of case-hardening, by which a relatively hard outer shell of not more than an inch in thickness is produced. Within this resistant and obviously less pervious shell, the clean crystalline soluble salts were frequently observed some distance from surface showings, as though their accumulation were not only favored but their existence protected after being once formed. Hard, dense, columnar basalt appears at intervals beneath the tuffs in the walls of the canyon, which in this locality is 150 to 200 ft. deep. Qualitative tests indicate the presence of potassium nitrate, associated always with lesser amounts of chlorides, sulphates, and some carbonates. So far as can be learned, prospecting or exploitation has been abandoned in both of the last mentioned localities.

Lake County. In the Warner Lake region, the front of the great fault-scarp, which borders the Warner valley on the east, rises precipitously for the most part to a height of from 1600 to 1800 ft. above the level of the lakes. Along this front a series of relatively flat-lying beds of volcanic lava are exposed, including a considerable thickness of inter-bedded tuffs and tuff-breccia. Near the top or rim of this great wall the lavas generally consist of basalt, while underneath are many less basic varieties, probably andesites, or even rhyolites. Nitrate claims have been filed upon ground extending along the base of these cliffs on the east side of the Warner valley for a distance of 12 miles. The showings so far found came from out-cropping pink and gray beds, probably andesitic tuff, from 500 to 700 ft. above the level of the lakes. In places these beds consist of reddish scoriaceous masses, and it is in these more open-textured portions that the chief traces of nitrates are found. Samples sent from this locality by O. B. Hardy of Lakeview contained nitrates in notable amounts. I made a careful examination of these tuff-beds for some distance along the outcrop within the limits of the filings, and samples were taken from several of the most likely points. Qualitative chemical tests made by G. E. Stowell revealed scarcely a trace of nitrates and but little more of common salt and soda.

Wagontire Mountain District. Wagontire mountain is a series of dissected ridges radiating from a flattened conical elevation that has the appearance of having been uplifted since the later basaltic lavas spread over the region. The bulk of the Wagontire mountain mass is of acid varieties of lava—rhyolite, rhyolitic tuff, and breccias. The Wagontire group of hills is in northeastern Lake county, and extends eastward into contiguous portions of Harney county. The highest point rises 6375 ft. above the sea. Sheep mountain, lying to the north, appears to be a spur connected with the main elevation, and is similarly composed of acid tuffs and cellular rhyolite, impregnated in part with silica. The summit of Sheep mountain is approximately 5650 ft. above tide. Nitrates have been found in many places on Wagontire mountain and its environs. Streams have cut deep radiating gorges into the east, south, and west slopes, and in the sides of these gorges are almost continuous exposures of the rocks of which the mountain mass is composed. More resistant lavas form rim-rocks

extending for many miles. Where protected along the faces of these cliffs, in innumerable recesses at their bases, where they have been under-cut, or where they rest upon the tuffs or less resistant lavas, nitrates and associated salts appear on the walls of the rocks, as a lining of caverns, in crevices, in the talus, and in the organic matter and dirt accumulated on the floors of caves, and frequently to an unanticipated extent, permeating the pores and vesicles of the rock itself. Almost invariably there is evidence of the occupancy of these openings in the rocks by different forms of animal and bird-life that inhabit the region today. Along the gorge of Lost creek, which flows to the north-west, and in others that lead down the west and south-west slopes of Wagontire mountain, the nitrate is present in a great many exposures, and most pronouncedly on the north wall of these gorges, and in exposures which face in a general southerly direction.

The American Nitrate Co. did a considerable amount of prospecting for nitrates on Wagontire mountain in 1916. Samples taken from many places on the ground by myself and G. E. Stowell, showed the presence of nitrates, associated usually with sodium bicarbonate, sodium chloride, and often with calcium and sodium sulphate, and lesser amounts of alum. On some exposures the ordinary saltpetre was the more plentiful, while in others Chile saltpetre ($NaNO_3$) prevailed. In no sample, however, representing a large body of the rock, was the percentage of soluble salts more than a fraction of one per cent. The response to tests for nitrate on materials from below the soil-line at the top of the talus was always negative. Positive tests were obtained on the cliff as high as 25 ft. above that line, and to a varying distance inward from the face of the rock where drifts were cut, the amount invariably decreasing, with added depth. There are several facts that should be called to mind in connection with the manner of occurrence, association, and possible origin of these salts. Both potash and soda nitre are found, the latter being somewhat more common than the former. They are usually accompanied by other soluble compounds, such as carbonates of sodium and lime, chlorides of potassium and sodium, sulphates of potassium, sodium, magnesium, calcium, and also aluminum as an an alum. On the other hand, one or more of the series of soluble salts enumerated occur in many places where nitrates are absent, in positions apparently identical with those that furnish strong nitrate reactions. It is also true that many obviously favorable points in a given region will be examined for nitrates in which neither they nor any other soluble salts are found. Thus a set of conditions is observed that is nearly uniform where nitrates have been found in Oregon. So far as known, nitrate salts are formed in Nature through the action of various species of bacteria upon animal refuse, and are normally produced in soils in the process of decomposition of dead plant life or humus. The alteration of the mineral constituents of the soil or of an alkali-bearing rock provides the needed alkalies for the formation of the inorganic salts or nitrogen. The other associated salts enumerated, result likewise from the alteration and decay of rocks, but do not require the intervention of organic processes for their production. The nitrates are extremely soluble, as are the chlorides, and most of the equivalent sulphate and carbonate salts of the alkalies and alkaline earths. As a result, all of these substances are susceptible to solution wherever water can reach them, and they accumulate only in positions where concentrated by evaporation. Natural deposits of large size, therefore, are rare, and are found only in arid or semi-arid regions.

Chemical examination of the circulating waters of the earth, particularly the water from deep wells and from springs, proves the universal presence in them of dissolved mineral salts. The sulphates, chlorides, and carbonates are most common, but it is notable that, in all waters coming from any depth nitrates are conspicuously absent. Usually, though not always, waters of higher temperature carry a larger proportion of these salts, which are dissolved from the rocks through which the waters have moved, and are produced either directly by the action of the dissolved gases in the water or they are removed from positions where they have previously been deposited by waters temporarily unable longer to contain them. The dissolved salts come originally from the decomposition of the rocks. Streams of all sizes gnaw their channels into the surface of the earth; in so doing the movement of the water in each successive water-bearing bed is intercepted. Different strata hold varying amounts of water, depending upon their character, position, and upon the rainfall of the region, so that the amount issuing from dissected strata varies from springs of great volume to the tiniest seepage. In arid regions, evaporation is excessively rapid. South-eastern Oregon is a region of low precipitation, where the loss by evaporation is correspondingly great.

In reviewing the localities where the nitrates have been found, it will be seen that typically they appear at the bases of ledges or cliffs where they cannot be seen to have apparent connection with moving water. The fact that these soluble salts are crystallized upon the wall-rocks, and to some extent within the pores of the rock itself, proves that enough moisture has been present to bring about such distribution, but that it has been lost by evaporation, leaving the salts where we find them. Other salts usually are associated with the nitrates, and these are the very salts that are always present in circulating underground waters. They are deposited wherever these waters reach the surface and evaporate. This leads to the inference that where these diverse types of soluble salts are found associated the moisture that deposited one type also deposited the other; but since, so far as we know, the method of origin of the two is widely different, the sources from which they were derived by the water must likewise be widely separated. The association of the nitrates in most of the deposits in south-eastern Oregon with one or more of the groups of other soluble salts is thus fortuitous, not genetic. This conclusion is strengthened by repeated observations of sul-

phates, chlorides, carbonates, to the exclusion of the nitrates, in positions similar in every way to those where nitrates exist either almost alone, or accompanied by the other salts. Many favorable places also show no salts of any kind. The bases and outer walls of cliffs are favorable places for the escape of water into the air. If the particular stratum happens to be dry, there will be no water to escape, hence no deposition of salts. If the water that escapes carries no matter in solution, no salts will be deposited. Finally, if the point of escape is so exposed that salts once left are again washed away there will be no encrusted salts. Hence one exposure may be barren, and another, apparently of similar environment, may be charged with soluble salts. It is the presence of representatives of the group of soluble salts that characterize circulating underground waters everywhere, and particularly in regions of volcanic and related rocks, which is the key to the origin of the Oregon deposits and to the agent that has effected their accumulation.

For the origin of the nitrates we must look to one or both of these sources. The soils of the region where nitrates have been found, are generally thin or even absent over considerable areas. The chief form of vegetation is a sparse growth of sage-brush, while a low annual precipitation makes conditions less favorable to nitrification than in regions of moist climate. The other source of organic matter in a region such as this, is the accumulated refuse of animal and plant-life that exists in many of the caves and protected recesses where the nitrates are found. It is by the artificial nitrification of masses of animal refuse that some commercial nitrates are produced, and it is recognized that, in other parts of the world, cave nitrates have been formed by this process. In the presence of an adequate amount of moisture, there is reason to believe that nitrification and the production of nitrates, has taken place in many of the cave-earths of south-eastern Oregon, and that it is by this method that most if not all of those yet discovered have been produced. Of the various exposures showing nitrates in 10 separate localities in south-eastern Oregon, the majority are closely related to such cave accumulations. Caverns containing an abundance of organic refuse in which no nitrates appear are not uncommon. Also occasional showings of nitrates occur in places where organic matter is now not in evidence. In dry caverns nitrification does not proceed, in extremely wet ones, the salts are washed away; in other places caves may be abandoned by their inhabitants, or the salts may travel by capillarity some distance in a porous rock and appear where there is now no obvious relationship between them and their organic source. Where the nitrates are found in association with other soluble salts, it simply has so happened that their position coincides with the place where the underground waters, with their dissolved contents, have reached the surface in some abundance and have deposited their load of salts by evaporation.

With the above facts of origin in mind, it should now be possible to draw some serviceable inference as to the probable extent of such deposits. It has been shown that the origin of the nitrate compounds is without question at the surface. The question will at once arise, if these are but concentrations at the surface, will they not be constantly replenished, and, if removed, be replaced by a never-failing supply? The answer is that, in places, there is some evidence that salts, other than nitrates, are now being deposited, but at a much slower rate than formerly. In any case, the rate of accumulation could not be expected to furnish a recurrent supply for commercial operations.

BROMINE is derived from bittern left after extracting salt from the brine pumped from deep wells at Mount Pleasant, Midland, Saginaw, St. Charles, and Bay City in Michigan; at Pomeroy in Ohio; and at Mason, Hartford, and Malden in West Virginia, according to R. W. Stone of the U. S. Geological Survey. The element bromine does not occur in native form, but is derived in large quantities from natural brines. It exists in all sea water and in most mineral water and salt springs, and has been found in giant kelp (sea-weed). Bromine is at ordinary temperature a volatile heavy mobile liquid of a reddish-brown color, giving off reddish-brown vapor. The vapor when inhaled dilute resembles chlorine in smell and in attacking the throat and nose, but in addition it has a very harmful effect on the eyes. The liquid is very poisonous and produces burns on the skin. Bromine is used in many chemical reactions as an oxidizer instead of chlorine, also in dissolving gold and separating it from platinum and silver, and in manufacturing disinfectants, bromine salts, and aniline colors. Perhaps the best known and most widely used bromine salts are bromide of silver, used in photography, and potassium bromide, used in medicine where it is desirable to depress the nervous system. Because of its harmful effect on the eyes, nose, and throat, bromine is now used in large quantity for grim purposes of warfare. To increase the domestic supply the Government has arranged for the drilling of additional salt wells in Michigan, which were expected to be producing bromine-bearing brine by July 1918. The output of bromine in 1917 was 895,499 lb., worth 55c. per lb., a gain of 23% in quantity over 1916, but a drop of 76c. in the price.

ON first melting copper cathodes the bath takes up sulphur from traces of the electrolyte left on the sheets, and from the fuel. This sulphur is totally eliminated during the period of oxidation by the reaction of Cu_2S with Cu_2O. When the Cu_2O has been sufficiently reduced by poling, this reaction is reversed and sulphur is absorbed, some from the hot gases, but more from the cover of fuel on the bath. A coke cover gave 0.0024% S in the final product, and a charcoal cover only 0.0011%. The lower sulphur also entailed a corresponding reduction in oxygen from 0.045 to 0.021% to give the proper pitch. The data were obtained from samples taken at intervals during the various stages in the routine operation at the Raritan Copper Works, Perth Amboy, New Jersey.—S. Skowronski, in Bull. A. I. M. E.

Concentrates

PEAT is used as a fertilizer and in compounding stock feed, as well as for fuel.

THE CREEP OR SLIP of belts is largely responsible for their wear. To lessen this wear pulleys should be as smooth as possible.

SPUN GLASS woven into cloth is a light diffuser, a non-conductor of electricity, a good insulator, and acts well in the filtration of acids.

WHEN WIRE-ROPE winds upon itself on a drum there is a crushing action on the rope, and where possible this condition should be avoided.

FILTER-PAPERS are made under several classifications. For qualitative work there are four kinds; for single-acid wash, two; and for double-acid wash, four.

TUNGSTEN MINERALS—ferberite, hübnerite, scheelite, and wolframite—were originally formed during certain phases of the consolidation of granitic magmas.

THE LENGTH of the flame in coal-dust firing is an indication of efficiency in combustion. If the flame is not more than five or six feet long, good work is being done.

MICA-SCHIST is now used as a furnace-lining, blocks being cut to the desired shape. In 1917 there was 39,975 tons used for this purpose. The price was $2.15 per ton.

MOVING PICTURES are now used to show, by means of photo-micrographs, the gradual changes in the structure of a metal when it is subjected to repeated bending stresses.

PLATINUM finds another use as a 'bridge' between the two leads in an electric detonator. This connection is in the guncotton or mercury fulminate, which is loose in the detonator, lying just above the packed fulminate.

COPPER CONCENTRATE, 50% grade, weighs 157 lb. per cubic foot; that of 15% grade, 128 lb.; and 65% ore, 188 lb., as packed for shipment, according to the U. S. Bureau of Standards. Crude oil weighs 51 lb. and sulphur ore 50 lb. per foot.

SAND-FILLING of stopes in the Simmer & Jack mine on the Rand cost 1.685 pence (3.370 cents) per ton of ore milled, and 6.074 pence (12.148 cents) per ton of sand lowered into the mine. This is based on the handling of 1,722,585 tons of sand in 7½ years.

CHROME is found disseminated through tachylyte near Webster, Jackson county, North Carolina, according to the 'Manufacturers Record'. A concentrating plant has been erected to treat this material. Tachylyte is a non-olivinaceous basalt, containing 45.73% SiO_2, 20.15% Al_2O_3, 12.46% Fe_2O_3, 8.67% CaO, 4.11% K_2O, and 5.74% Na_2O.

GOLD ABSORBED by copper plates varies in quantity. A 'primary' plate (directly under mortar-box) at one of the Rand Mines mills, after 20 years' service, yielded only 13.05 oz. of fine gold after being thoroughly scaled. Four others gave 24.05 oz. each, twelve gave 23.33 oz.; while five secondary plates (below the tube-mills) yielded 14.47 ounces.

GYPSUM is widely used as a fertilizer. Its action on the soil is indirect; it is not a food for plants, but it is supposed to act on the double silicate of magnesia and potash in the soil, freeing the magnesia and potash, so that they become available as plant food. Its use is believed to be beneficial only if these elements are present in the soil, and its application to some soils would therefore be of no advantage.

AMALGAMATION OF GOLD when ore is crushed through a coarse screen is difficult. At the Van Ryn mill on the Rand, corduroy was laid down in place of copper plates. This saved the gold as a rich concentrate. The corduroy was of the 'elephant' grade, 4 sq. ft. per stamp, or 0.49 sq. ft. per ton of ore per 24 hours. The tables had a grade of 12½%. Each ton yielded 0.272 lb. of concentrate, assaying 2.1% fine gold. This was ground in a barrel, with mercury, the amalgam retorted as usual.

THE CHINESE generally do not understand the relationship between paper currency and hard coins; they exchange the former for coins as soon as they can. If a gold standard were adopted by China, the gold would be hoarded. It is easier at present to maintain a silver standard system, and for China to unify the currency, according to a Japanese financier. Once the people were educated to the value of paper money, the gold standard could be introduced. Foreign paper money circulates in China, adding to the currency complications. It is estimated that it will take ten years to reform the Chinese currency problem, at an expenditure of Y500,000,000 ($250,000,000).

LUBRICATION of air-compressor cylinders is of greater importance than supposed. Disastrous explosions have resulted from using ordinary engine-oil in the air-cylinders. Only a pure mineral oil, with a flash-point as low as good lubricating qualities will permit, should be used. As little as possible of even the best oil should be used. Numerous cylinder-oils are compounded, and such oils are likely to produce a carbon that will stick the valves and collect on valve-faces and other parts of the cylinder and valve-chambers, resulting in a dangerous condition. Lubrication of the air-cylinder with soapsuds (preferably made of soft soap, about 1 part soap to 15 parts water) for a few hours each week (or less frequently if the load is light), instead of oil, will help materially in keeping the cylinder clean. To prevent rust from this a little oil may be fed in before shutting-down any time.

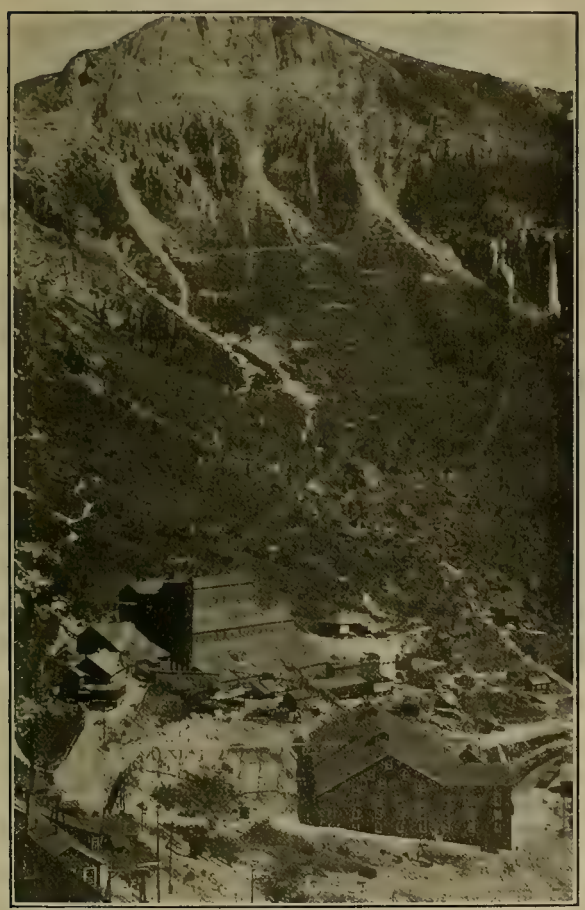
REVIEW OF MINING

SILVERTON, COLORADO

Mining in the San Juan Region.

Silverton.—The Sunnyside mill is producing 500 tons of lead concentrate per month.

The Mears & Wilfley flotation mill has three shifts working. As the season is short, the operators must work at full capacity. During the two months that remain of the present season they expect to ship over 200 tons of concentrate each month.



SMUGGLER-UNION MILL AND WATER-POWER—BRIDAL VEIL FALLS—TELLURIDE, COLORADO.

As the old Veta Madre mine has not been worked for a decade, the present operators have considerable trouble in timbering and cleaning out, but feel confident that they will be amply repaid.

Red Mountain.—This district is handicapped by a shortage of men, notwithstanding a wage of $5 per day. However, ore is being shipped in large quantities. Rich copper ore is also bringing good returns.

Some new orebodies have been opened in the Congress mine of the Kapegi Leasing Co. Regular shipments are made of 15% copper ore, about 30 tons per day.

Rico.—A large amount of development is being carried on in this district, and shipments of ore are encouraging. The Iron, Resolute, Expectation, and others report good results.

Telluride.—J. M. Belisle has found a market for oxidized iron ore from his claims near Ophir. The ore carries 50% iron, and is in demand for fluxing purposes.

The new mill of the Belmont Wagner Co. is concentrating 100 tons of ore daily. When the compressor is working this tonnage will be doubled. The hauling and erection of this large compressor involved difficulties, as the road to the Alta mines is steep, and of dirt construction. The contractors for hauling finally dismantled the large piece of machinery and hauled the separate parts.

The Carribeau Trust Co. suffered a loss of $2000 when the bunk-house, boarding-house, and assay-office were burned to the ground. The fire is supposed to have started in the assay-office from a defective gasoline heating system. The owners continue to ship ore.

Ouray.—Considerable prospecting and development is being carried on, although shipping is not heavy.

The Ouray Consolidated Mining & Reduction Co. has shipped small quantities of ore and concentrate from the Indiana, Grey Eagle, and Morning Star mines. At present the mill is concentrating Gem and Float copper-silver ores.

LEAD, SOUTH DAKOTA

New Work in the Black Hills.

Hill City.—The American Tin & Tungsten Co. has resumed work here under new management. The Cowboy mine is being unwatered. When this is done development will be continued. The concentrator is undergoing repair and additions, to enable it to handle 100 tons of ore in 24 hours. It is proposed to dress tin ore only. The Anna and Mohawk properties have been taken over under lease. To eliminate haulage by team, a motor-truck has been purchased, to carry ore from the mine to rail.

Since commencing work at the Blue Lead copper mine, 15 cars of ore have been shipped to the smelter. A new boiler and compressor are being added.

Custer.—The 100-ton concentrator at the Spokane lead-silver mine is in commission. Concentrate is hauled to Keystone, the nearest rail point, for shipment to smelter. In dressing the ore, Card sand and slime tables are employed. A satisfactory recovery is made.

A. E. Foye is erecting machinery at his mica mine east of Custer, and expects to produce both scrap and sheet material within a few weeks.

Pringle.—The Pringle Granite Co. has put in machinery, and will open a quarry within a mile from rail. The granite will be used for building and monumental purposes.

Keystone.—The Lithia mines are all active, and a large daily production is made. This could be further increased

but for the shortage of labor. Three concerns are shipping, the Standard Essence Co., the Rheinbold Met. Co., and A. T. Roos.

The Producers Mica Co. has a lease on the Last Chance mica deposit and is making shipments to Chicago.——Nichols brothers and Miners are also shipping mica from a property near Hayward.

Lead.—E. Manion, who has leased the Bismarck mine at Flatiron, is recovering considerable tungsten along with the gold ore. It is of good grade and only requires a little hand-sorting. The cyanide plant has been in continuous operation for several months, with satisfactory results.

Deadwood.—O. Seim is loading several cars of pyrite for shipment. This will be a trial to determine just what can be done with it. There is a large deposit and if the sulphur content is sufficient a large quantity can be shipped.

The Echo company has resumed work. Electric pumps have been installed and a lead-silver body will be thoroughly developed.

The Titanic is making arrangements to resume operations. Contracts have been let for driving a 1000-ft. tunnel.

Roubaix.—At the Jungle mine, one of the properties of the Custer Peake Copper Co., work continues. Shipments of ore have commenced to the smelter.

PLATTEVILLE, WISCONSIN

Principal Operations in All Parts of the Field.

Highland.—The New Jersey Zinc Co. raised miners' wages in this district 25c., making the total $4 per day. The No. 2 Clark mine is a remarkable producer of zinc ore.

Linden.—A scarcity of coal resulted in a shut-down of steam-driven plants in this district, and nearly all of the low-grade zinc ore producers are idle.

Mineral Point.—The Mineral Point Public Service Co., supplying electric power to the northern parts of this field, is reported to be in financial difficulties, and will be taken over by the Inter-State Light & Power Co. of Galena, Illinois.

The Mineral Point Zinc Co. is making shipments of 66% sulphuric acid at the rate of 6 to 10 tank-cars per week. Two separating-plants, dressing low-grade zinc ore, turn out from 700 to 800 tons of 60% concentrate, which is delivered to smelter at DePue, Illinois.

Dodgeville.—The Lucky-Five Mining Co. has completed plans for the construction of a new 100-ton mining plant to replace the one destroyed by fire several months ago.

Mifflin.—This district holds second place among producers in the field. The Coker and Yewdall mines are the largest.——The Peni mine has been abandoned and the surface equipment sold.——Extensive development is being done by the Vinegar Hill Zinc Co. on the Rundell lands. A new 200-ton mill is in course of construction.

Platteville.—There are three producers in this district. No shipments have been made recently, and it is stated reliably that there is held in bin over 3000 tons of choice zinc concentrate held for better markets.——Extensive drilling operations for the Wisconsin Zinc Co., on land north of the city, are being rewarded with fine strikes of zinc ore. H. C. George is geologist in charge.

Benton.—This district, leading the field for years in output of zinc ore, shows the stress of low markets and disrupted labor conditions. Shipments are now only 45 cars weekly, against 80 cars previously.——The Burr mine, for several years a consistent producer, has been abandoned and the mill removed to the Galena district.——New producers are the Iowa, Robson, and the Ida-Blende, the last recently equipped with a 100-ton mill. Several thousand tons of low-grade zinc ore is held in reserve at this centre.——The New Jersey Zinc Co. has developed a wonderful producer—the Hoskins—of zinc ore, shipments averaging 300 to 400 tons per week.——The Kittoe mine, under Vinegar Hill management, is said to be almost exhausted.

Shullsburg.—New producers are being developed in this district, and shipments of ore show gains. The Copeland mine of the Wisconsin Zinc Co. is shipping from 5 to 7 cars. Another good producer is the Oliver mine.

Hazel Green.—The only constant shipper from this district is the Kennedy mine, a steady producer for the past 25 years.——The Jefferson mine has had an uphill fight against water, lasting for nearly a year.——The Monmouth and McMillan mines, with two expensive rigs, are both idle.——The Cleveland and Lawrence mines are also closed. The field generally is dull.

Galena.—Two mines continue regular weekly shipments from this district—the Black-Jack of the New Jersey Zinc Co. and the North Unity of the Vinegar Hill Zinc Company.

GOLD HILL, OREGON

Shortage of Labor and Plant.—Copper, Manganese, and Chrome.

General operating conditions in the Gold Hill district since last season have been unfavorable, especially in mining, due to the scarcity of laborers and equipment. The 1000-bbl. capacity cement plant here, suspended last spring due to the inability to secure fuel-oil, has about exhausted its large stock of cement, and will be unable to resume. The State 200-ton limestone plant, built to supply Oregon farmers with fertilizer at cost, started late last fall and expected to be in operation early in the spring of 1918, has just been completed, due to a shortage of skilled mechanics and difficulty in procuring machinery. The Gold Hill Irrigation District has begun the construction of a 15-mile ditch and diverting works, three miles above Gold Hill on Rogue river. It is favored by having a number of local rock men who have been employed by several large saw-mills suspended for the season due to shortage of labor.

Jerome A. Hilbert, superintendent of the Blue Ledge copper mines, reports a monthly output of 300 tons of ore carrying over 12% metal. The wagon-haul charge to rail at Jacksonville is $10 per ton. Machinery consists of two air-compressors, Pelton water-wheel, two boilers, drills, and aerial tram. Development consists of 12,000 ft. Reserves are estimated as 250,000 tons.

D. E. Wells of Rogue River, formerly with the Engels Copper Mining Co. of California, who has been developing a gold mine 10 miles north-west of Gold Hill, has taken over the Neathammer manganese deposit in the same locality, under lease to M. S. Johnson, at Gold Hill.

D. B. Reynolds has been engaged to unwater the old Tyson chrome mine on Chrome hill, near Smith river, controlled by the American Exploration & Development Co. of Grants Pass. This property is said to be the oldest chrome mine in America, being worked in the early seventies, but abandoned in 1875. The main shaft is 85 ft. deep.

JEROME, ARIZONA

Recent Important Exploration in the Verde District.

The Grand Island Mining Co.'s shaft, recently enlarged to three compartments to a depth of 208 ft., is down three sets below the 200-ft. level. Good headway is being made in sinking. A diamond-drill hole from the surface, 250 ft. south-east of the shaft, is being run at an angle of 64° from the horizontal and will cut the shaft at about 550 ft. The bit was down 200 ft. on August 20. The formation is jasper, with occasional schist. This work is being done to prospect at depth the quartz and porphyry formation cut in a drift run west from the shaft on the 200-ft. level. The annual meeting is to be held September 11. A total of $117,971 in current assets on June 30 consisted of: supplies,

$1494; cash, $2126; United Verde Extension shares (2820 at purchase-price) $105,964; Liberty Bonds, $6000; accounts receivable, $2387. For the year ended June 30 development expense was as follows: 858 ft. of cross-cuts and drifts, $27,778; assessment work, $635; 90 ft. of shaft work, $4500; and 3097 ft. of diamond-drilling, $13,396; a total of $46,309.

Since July 27, when diamond-drilling started at the Calumet & Jerome, a total of 1060 ft. has been driven in three holes. No. 2 was driven horizontally from the long south-west cross-cut 340 ft. to the side-line of the property. No. 3 was also a flat hole, 270 ft. long. These two holes cut through a sheared schist-zone carrying some chalcopyrite and bornite. No. 1, a vertical hole, was bored in the sheared zone south-east of the shaft, on the 600-ft. level, and attained a depth of 450 ft. A new hole, No. 4, is being drilled near the winze on the 600-ft. level. This will be run vertically at an angle of 70°, to a depth of 500 ft. Its purpose is to explore at greater depth the sheared zone, which carried so much disseminated chalcopyrite. All the holes so far driven have been plugged on account of water.

The Jerome Verde will begin shipping ore from the Maintop orebody about mid-September. By that time everything will be ready for handling the ore through the Columbia shaft. A combination ore-bin, sorting platform, and waste-bin, having a capacity of 100 tons, is being constructed near the shaft, so that the ore may be hoisted and run out to the bins from a point 10 ft. below the collar. The raise from the 1100 to the 900-ft. level of the Maintop claim was finished last week, and a drift is now being driven to connect with the old 900-ft. drift, which leads to the Maintop orebody. On December 23, 1917, the contract between the United Verde Extension and Jerome Verde, which allowed the latter the use of the U. V. X. hoist, trams, etc., to handle the ore being extracted from the Maintop, expired; and it was necessary for the Jerome Verde to make other arrangements for extraction and transportation. A connection had already been started north from the Columbia shaft, thence around U. V. X. ground to the Maintop. This was finished a short time ago, so that it is now possible to tram entirely through Jerome Verde workings to the Columbia shaft, a distance of 3500 ft. Up to the time of the expiration of this agreement, 1600 tons of ore had been shipped to the smelter at Humboldt from the Maintop orebody. The last lot assayed 9.77% copper, 2.25 oz. silver, and 0.06 oz. gold. In order to reach the railroad at Clarkdale for transportation to Humboldt, the ore must be trammed by mules from the raise to the Columbia shaft, a distance of 3500 ft., hoisted to the surface, then hauled by wagon a distance of over five miles.

PORCUPINE, ONTARIO

Conditions at Porcupine, Kirkland Lake, and Boston Creek.

The supply of labor has lately been further depleted by the call for men to assist in harvesting the crops of western Canada. The situation on the goldfields, more especially Porcupine, is worse than ever; moreover, the efficiency of the labor that is obtainable is much below that prevailing before the War. The Hollinger Consolidated, despite present unfavorable conditions, continues production. It paid 1% dividend in June and another in August. The statements of output are not published now.

The McIntyre is also operating steadily, making a good profit. The annual report for the year ended June 30 is expected to show ore-reserves valued at $5,000,000, and a surplus of nearly $1,000,000. Owing to the greatly decreased demand for electric energy, due to the closing down of mines, the power-plant at Sandy Falls has been stopped.

Kirkland Lake.—The Lake Shore mine during June produced gold valued at $43,353, from 1761 tons of $24.61 ore. An initial dividend of 2½% has been paid. The July output will be slightly less, owing to mill repairs.

At the Kirkland Lake mine, good progress is being made in construction of the new mill. The shaft will soon reach the 300-ft. level, and will be continued to 500 feet.

According to cable advice, litigation in the British courts in connection with the Tough-Oakes mine appears to have resulted in favor of the London interest, Clement A. Foster having been awarded some money. Further proceedings have been taken in Canada, Henry Cecil having sued Mr. Foster and the original promoters for $150,000, as commission on the sale of shares.

Boston Creek.—Increased interest is being manifested in this district. Merchants are preparing to move to a new townsite near the railway station, on which work will shortly be begun. The Northern Ontario Light & Power Co. has entered the field, and is arranging to supply power to the Patricia mine. At this property the mill is treating 30 tons per day. The vein is from 2 to 4 ft. wide on the 200-ft. level, of high grade. About 94% extraction is made by amalgamation.

TEXAS

Condition in the Terlingua Quicksilver District.

Terlingua.—J. A. Udden, director of the Bureau of Economic Geology and Technology in the University of Texas, recently returned to Austin from a visit to the Terlingua quicksilver district, where he made an examination

PART OF TEXAS, SHOWING QUICKSILVER DISTRICTS.

of the producing mines and claims that are being developed. He said that there are four producers, namely, the Chisos Mining Co., Big Bend Mining Co., Marfa-Mariposa Mining Co., and the Ellis interests. The Chisos company is operating two furnaces, and is the largest producer. Two new groups of claims, known as the Wallingerger and Chisholm, owned by L. T. Millican of Denton, Texas, and associates, are being developed under direction of James La Faralle, formerly in charge of the Chisos mine. These claims adjoin the Chisos workings. Mr. Udden said that the road from Marathon, the nearest railroad station on the Southern Pacific, to Terlingua, 90 miles, is in fairly good condition. The Federal government has done some work on the road, as it is used by motor-trucks to supply the military patrol camps in that part of the Rio Grande border. The heat in the Terlingua district at this time of the year is intense, and little outside work can be done in the way of prospecting. Most of the buildings at Terlingua are of galvanized iron, which contributes to the intensity of the heat.

ARIZONA

Ajo.—The New Cornelia's new shaft to develop sulphide ore is down 250 ft. A station is being cut and a haulage-drift started.

The old Gunsight mine, east of this place, is said to be opening well to a depth of 170 ft. The ore carries lead and silver.

Seven miles east of Gunsight the 5-stamp mill of the Gunsight Gold & Tungsten Mining Co. is being overhauled. A 40 or 70-ton ball-mill is to be added.

Bisbee.—Shattuck Arizona has issued a statement covering the second quarter of 1918. The net profit was $116,883. There was 3957 ft. of development done. A large tonnage of 2 to 7% copper sulphide ore was found between the 800 and 900-ft. levels. Ore shipped amounted to 24,430 tons of copper and 529 tons of lead, yielding 2,489,099 lb. of copper, 272,294 lb. of lead, 46,361 oz. of silver, and 336 oz. of gold. The net operating cost per pound of copper was 13.789c. The lead concentrator was expected to start early in August. Dividends this year amount to $1.50 per share, equal to $525,000, making $6,912,500 to date.

Globe.—Copper production of the Old Dominion in July was 2,530,000 pounds.

Kingman.—The new leaching-plant of the Emerald Isle Copper Co. will be in operation by September. This plant is expected to produce 2000 lb. of refined copper and 1000 lb. of cement copper daily. A large tonnage of oxidized ore has been developed.

The Arizona Venture Mining Co., recently re-organized as the Waldron Mining Co., has commenced unwatering its 600-ft. shaft prior to commencing further development.

The Cactus Queen Copper Co. has purchased several old plants near Wickenburg, and will dismantle them to obtain the necessary machinery for its new plant.

The Washington-Arizona company at Mineral Park recently opened 18 in. of rich silver ore. The mill is now treating the low-grade ore, while the high grade is being shipped.

The Berkley mine has been unwatered. The old workings are being cleaned-out and the shaft deepened. This work is opening good ore.

Patagonia.—At the Flux mine, controlled by Bisbee people, the 200-ton mill has been re-modeled by adding tables and flotation machines to dress the lead-silver ore. A large tonnage of ore is said to be available.

Ray.—Copper production of Ray Consolidated in July was 7,300,000 lb. The report of this company for the second quarter of 1918 shows that the profit was $2,255,217, of which $1,182,884 was paid in dividends. The surplus was $1,072,333, compared with a deficit of $471,316 in the previous period. Costs totaled 16.468c. per lb. of copper, an increase of 0.740c. The mill dressed 881,800 tons of 1.643% ore, recovering 75.81%. The daily tonnage was a slight decrease, but recovery was 2.21% higher. Mining cost $1.677, including 5.60c. for coarse crushing, and 97.753c. for milling. The output was 21,963,414 lb. of copper.

Tucson.—Full ownership of the Imperial Copper Co., at Silver Bell, and the subsiduary properties of the Sasco smelter, has been acquired by the American Smelting & Refining Co., for the sum of $125,000, by the purchase of the remaining 35% interest in the estate of Frank Murphy. It is announced that operations will continue on an enlarged scale.

ARKANSAS

Batesville.—Manganese mining in this district continues to attract much attention. A number of properties have changed hands. Leases are difficult to arrange. Water is scarce.

CALIFORNIA

Eureka.—As chrome is shipped in fair quantities (3 carloads last week) from this place in Humboldt county, the Northwestern Pacific Railroad is providing better facilities for handling the ore. Vessels bringing chrome from Del Norte county and the Klamath river will be able to unload quickly into cars. In Del Norte, R. D. Adams of San Francisco, is operating most of the chrome deposits. Road building is part of the necessary work. Manganese is being mined in districts tributary to Fort Seward and Carlotta. Regular shipments are made. Shortage of miners and lack of good roads are drawbacks.

Fenner.—At the old Bonanza King mine, worked 40 years ago at this place near Goffs, San Bernardino county, a complete cyanide plant is being erected, to be ready early in September. There is reported to be 20,000 tons of 20-oz. silver ore on the dump, and a large quantity underground. The machinery includes a tube-mill, agitators, and Oliver filter. Sodium sulphide is to be used for precipitation.

St. Helena.—According to 'Magnesite in 1917,' just issued by the U. S. Geological Survey, Napa county contributed 19% (40,218 tons) of the total (211,663 tons) output of crude magnesite mined in the State last year. The principal producer was the White Rock mine in Pope valley, 20 miles east of St. Helena or Rutherford. Six vertical kilns were added, making eleven in all. Calcining is done by dumping in alternate layers of coke and ore. The company also uses two kilns at Rutherford and two at Oakland. The product is much in demand by basic open-hearth and electric steel furnaces on the Pacific Coast. We hope to publish a description of this mine at an early date.

San Francisco.—The Industrial Accident Commission has called public hearings to consider tentative quarry safety rules and tentative electrical-station safety orders. For some weeks past, committees of employers and employees have co-operated with the safety engineers of the Commission in preparing the tentative rules and orders. A. R. Wilson, vice-president and manager of the Granite Rock Co., is chairman of the quarries committee. J. P. Jollyman, engineer of electrical construction for the Pacific Gas & Electric Co. and representative of the National Electric Light Association, served as chairman of the electrical-station committee. During the 24 months of 1915 and 1916 there were 32 fatal, 60 permanent, and 2314 temporary injuries in the quarries of California. The total cost in compensation and medical fees was $176,034. Electricity caused 739 injuries in California during 1915 and 1916, divided as follows: fatal, 50; permanent, 13; and tem-

porary, 676. The sum of $153,566 represents the medical and compensation costs. The tentative quarry safety rules will be considered at two public hearings, the first on August 28 at 525 Market street, San Francisco, commencing at 10 a.m.; and the second on September 11 in the Union League building, Los Angeles, same time. The tentative electrical-station safety orders will be the subject of discussion at two public hearings, the first on September 12 in the Union League building, the second on the 25th at San Francisco, both at 10 a.m. The Industrial Accident Commission extends to citizens an invitation to attend these hearings.

Sutter Creek.—Twenty stamps are dropping at the Central Eureka mine. All ore at present comes from the 3500-ft., or lowest level. The vein worked successfully at 3350 ft. and slightly developed at 3400 ft. has been cut on the 3500-ft. level, showing indications of producing a large quantity of good milling ore. A. S. Howe is superintending this property, which is at present the only mine crushing ore between the Kennedy on the south and the Keystone mine on the north of it.

The Knight company, local foundry-men and builders of mining and milling machinery, recently added to their equipment by the purchase of the large planing-mill across the creek from its shops, and heretofore conducted by D. V. Ramazzotti.

Yreka.—Twenty 3-ton auto-trucks arrived at Seiad in Siskiyou county on August 24, to engage in hauling chrome from J. F. Reiddy's mine to the railroad at Hornbrook, a distance of 66 miles up the Klamath river. The trucks were 3½ days making the trip from Oakland. Forty-two men were in the party, in charge of E. H. Green. The trucks can make a round trip in a day between the chrome mines and the railroad, delivering a total of 60 tons.

COLORADO

Cripple Creek.—On the 1200-ft. level of the Modoc Consolidated's Last Dollar mine a good shoot was recently opened. Large shipments are being made, and larger ore-houses are under construction. A. H. Frankenburg is general manager.

Leadville.—The pyrite deposits of Leadville are described by H. S. Lee in a paper prepared for the Colorado meeting of the A. I. M. E. The distribution of pyrite in this district is general; but, eliminating the smaller bodies and those containing prohibitive quantities of zinc or lead, and considering only the larger deposits commercially valuable for their sulphur, the chief pyritic orebodies extend in a zone approximately 6000 ft. long and several hundred feet wide, from the Yak and Moyer, on the south; through Louisville, Greenback, Mahala, Adams, and Wolftone, on Carbonate hill, across Yankee hill, and into the Quadrilateral, Denver City, and Tip Top, on Fryer hill. The orebodies are replacement deposits in the limestone along some minor fracture, or contact metamorphic deposits along some porphyry dike or fault. Summarizing, Mr. Lee says that there are large deposits of pyrite in Leadville, containing a minimum of 43% sulphur, suitable for the manufacture of sulphuric acid. In these deposits there are enrichment zones containing gold, silver, and zinc; but the system of mining in use will permit selective methods whereby the portions more valuable for other metals may be stoped separately and shipped to the smelter while the pyrite is kept clean for acid use. The only material available now is run-of-mine ore suitable for crushing and roasting in 'fines' burners. The problem of lump ore, both as to suitability and preparation, will be worked out only when there is sufficient demand to warrant experiments. The returning of residue from a pyrite originally containing precious metals to the value of, say, $2 per ton, after calcination in the Middle West, for smelting in Colorado, is financially practicable.

IDAHO

Adair.—The Richmond M., M. & R. Co. made a profit of $28,751 in July. The output was about 1000 tons of copper-gold ore, valued at $37,444. Forty-five men are employed.

Mullan.—The Consolidated Interstate-Callahan Mining Co. has issued a report for the second period of 1918. The net profit was $168,916. A dividend of 50c. per share was paid on June 15, making the total $6,742,355, or $14.50 per share. Liberty Bonds worth $50,000 were purchased. The mill dressed 18,720 tons of ore, assaying 16.19% zinc, 4.40% lead, and 1.49 oz. silver. On June 1 the plant was closed for alterations, now complete. The flotation plant handled 20,082 tons of tailing. Shipments to smelter were as follows:

Class of product	Tons	Zinc, %	Lead, %
Zinc ore	915	45.75	....
Zinc concentrate	11,354	46.26	....
Lead ore	478	10.98	40.72
Lead concentrate	1,062	15.71	49.39
Zinc contents, pounds		11,781,177	
Lead content, pounds		1,438,396	

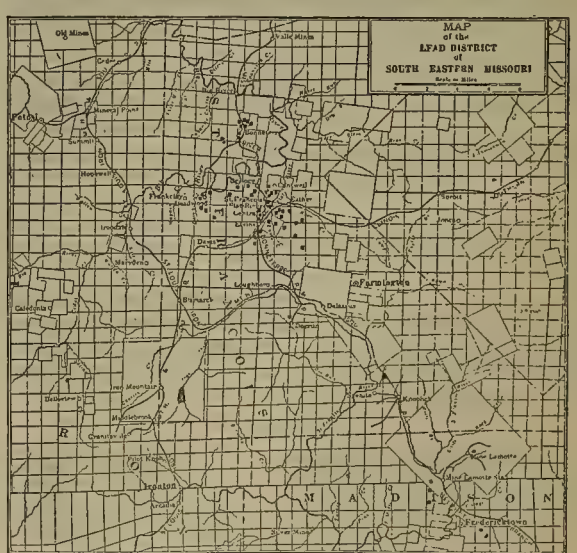
The recovery of zinc was 87.20%. The cost of mining was $5.006, and of milling $2.357 per ton. Mine development was satisfactory.

Wallace.—The Amazon-Manhattan mine in the Beaver Creek district has shipped 60 cars of lead-silver-zinc concentrate since the railway was restored. The ore was milled at the Ray-Jefferson plant, of 400-ton capacity. Reserves are said to be valued at over $2,000,000. The property adjoins the Con. Interstate-Callahan, and is owned by Jerome J. Day, Patrick Burke, Fred C. Robertson, Fred Miller, John M. Gleeson, and Joseph F. Morton.

Wallace.—The option on 1,100,000 shares of the Hypotheek company, held by J. K. George of New York at 15c. each, was given up last week. The company is to issue a statement at an early date. It has been in the limelight recently on account of the erratic price of the shares.

MISSOURI

Bonne Terre.—The National War Labor Board states that William H. Taft and Frank P. Walsh, sitting as arbitrators



on behalf of the Board in dispute between the management and employees of St. Joseph Lead Co. at its lead smelter in Herculaneum, have rendered an award which grants workers a general increase in wages, establishes a minimum wage, and provides a system of collective bargaining be-

tween employer and employees. Award is made retroactive to April 21. The arbitrators granted a wage increase on a sliding-scale in harmony with the principle recently applied by the Railroad Wage Commission giving to the $3 a day men a flat raise of $1, or 33⅓%, and graduating increase down to 10%, or 50 cents per day for those earning $5. For those earning more than $5 the increase was merely nominal.

Joplin.—Production of the region last week was 7839 tons of blende, 104 tons of calamine, and 1001 tons of lead. These averaged $56, $38, and $100 per ton, respectively. The total value was $543,103, of which Missouri yielded $105,265.

The Bankers Mining Co. is erecting a 250-ton mill northeast of Bell Center. Coal or gas may be used as fuel for boilers. I. P. Jones is in charge.

MONTANA

Butte.—The Butte & Superior Mining Co. reports a profit of $128,387 for the second quarter of 1918, against $327,982 in the first period. Costs rose from $9.7374 to $11.4451 per ton of ore, due to an accident at No. 1 shaft and other abnormal charges. The mill concentrated 114,716 tons of ore assaying 16.242% zinc and 6.154 oz. of silver, a decrease of 21,161 tons. The recovery was 90.925%, a drop of 4.537%. The yield was 33,881,677 lb. of zinc and 645,223 oz. of silver.

The Butte Copper & Zinc Co. reports as follows for the six months ended June 30, 1918:

Profit on zinc (22,700 tons shipped)	$132,106
Manganese settlements (28,900 tons shipped)	206,212
Amount due on 10,620 tons of ore shipped prior to June 30, all expenses paid	223,020
Total	$561,338
Deduct one-half for Anaconda company	280,669
Profit of Butte C. & Z. Co., plus interest, and less expense	269,338

Manganese shipments are now between 275 and 300 tons daily. Zinc production is being steadily lessened. After August it is hoped that the manganese can be sent to the ferro-manganese plant of the Anaconda company at Great Falls.

Kendall.—Barnes-King Development Co. paid dividend No. 6, of 10c. per share, on August 15. This amounted to $40,000, and makes $220,000 to date. The report for the second quarter of 1918 shows that receipts from gold, etc., totaled $182,036, plus $276,599 brought forward, making $458,635 available. All charges amounted to $244,818, including dividend of $40,000 and Liberty Bonds of $25,000. The quarter's profit was $58,679. Balance on June 30 was $181,523. The mines yielded as follows:

Mine	Tons	Value per ton	Profit
Kendall	765	$2.97	$925
North Moccasin	5580	9.25	15,282
Piegan-Gloster	4694	10.23	9,341
Shannon	8210	9.55	33,573

An option was taken on the Mount Pleasant claim, ¾-mile from the Shannon, the amount being $30,000, on terms. The property is considered encouraging, and yielded to previous owners 1200 tons of $30 ore. Costs of labor and supplies have advanced 50% in recent years.

NEVADA

Battle Mountain.—According to F. S. Schmidt, manager of the Copper Canyon Mining Co., operating in Copper canyon, 18 miles from Battle Mountain, the daily output is 30 tons of 8% ore. The increased freight and smelter rates and higher wages leaves the company little profit.

Ely.—Nevada Consolidated produced 6,400,000 lb. of copper in July. The report of this company for the second quarter of 1918 shows that a surplus of $852,578 remained after paying 75c. per share on June 30. Cost of producing 21,507,909 lb. of copper was 17.72c. per lb., compared with 18.07c. in the previous period, when 17,435,164 lb. was recovered. The mill concentrated 1,067,212 tons of 1.54% ore.

Goldfield.—Blair marsh, 25 miles from this place, is to be prospected for potash by J. W. Crane of Goldfield, who has a permit. A spring-pole drilling machine is to be used for holes less than 100 ft. deep, and a Keystone driller for over that depth.

Placer mining in Tule canyon, 35 miles south, is attracting attention lately. One property, worked by Hanus and Field, has a 12-hp. distillate hoist and 500-gal. pump. They are working in wash below bedrock.

Tonopah.—Production of the district in the third week of August was 9510 tons of ore valued at $161,670. Some July returns were as under:

Mine	Tons	Silver, oz.	Gold, oz.	Profit
Belmont	7,847	108,409	1,120	$58,635
Jim Butler	1,810	.....	....	30,622
Tonopah Mining	16,235	116,820	1,198	53,000

The West End is treating 4000 tons per month of its own ore, also ore from a number of lessees and small mines. On the Ohio vein, on the 500 and 800-ft. levels, high-grade ore is being extracted.

In the Divide district, a good progress is reported from the Divide, Dividend, Brougher, and Gold Zone. New machinery is being erected at the Divide. Over 5000 tons of ore is on the dump, and 50 tons daily is to be sent to Goldfield for treatment. Cyanidation has extracted 92% of the silver and gold. The proportion of these metals is 80 to 1. The latest development on the 370-ft. level shows $56 ore across 24 ft. The Dividend is cross-cutting at 300 ft. depth, and the Brougher at 177 feet.

NEW MEXICO

Santa Rita.—The Chino Copper Co. report for the second quarter of 1918 shows a profit of $1,916,513, dividends $869,980, and surplus $1,046,533, compared with $1,124,254, $1,304,970, and $180,716, respectively, in the previous quarter. Costs totaled 16.36c. per pound, an increase of 1.12c. Steam-shovels removed 940,057 cu. yd. of overburden. The concentrating plant dressed 901,500 tons of 1.5773% ore, recovering 66.93%. The total output of copper was 19,030,992 pounds. Chino produced 6,310,396 lb. of copper in July.

OKLAHOMA

Peoria.—The Nebo Lead & Zinc Co. is erecting a 200-ton mill, to be ready by October 1. The machinery includes a 100-hp. steam engine for the mill, 80-hp. engine for a compressor, crusher, four sets of rolls, three jigs, and five tables. Three shafts have opened ore from a depth of 130 to 176 ft. J. E. Turner is general manager.

Picher.—Production of the districts last week was 5464 tons of blende and 813 tons of lead, valued at $388,828.

North Century.—The Maxine Mining Co. is building a 500-ton mill near here. The mine has been thoroughly developed.

UTAH

Alta.—As the Salt Lake & Alta railroad is unable to supply enough cars, shipments of ore from this region are not moving as fast as they might. There is talk of putting tractors on the road.

Bingham.—Utah Copper Co.'s report for the second quarter of 1918 shows that the profit from operations was $5,483,813, more than double that of the first quarter. Dividends totaled $4,061,225. The surplus, including other income, was $2,432,152, almost 10 times that of the March period. Costs were 15.047c. per pound, compared with 15.484c., due to a larger tonnage. The mills concentrated 3,201,900 tons of 1.2535 ore, recovering 64.49%. This

quantity was 22% more than in the previous three months. The copper output amounted to 51,764,783 lb., a gain of 11,000,000 lb. Utah Copper produced 16,021,766 lb. in July.

Princeton.—The Canada Copper Corporation continues its extensive operations. Several miles of truck roads have been constructed to the mill-site; a 16,000-ft. sawmill is now at work. Some excavating has been done for the 2000-ton mill; a warehouse, machine-shop, 160-seat dining-room, and cottages have been built; and the head office is to be moved from the smelter at Greenwood to Princeton. Oscar Lachmund is general manager.

Sandon.—The American Boy silver-lead mine, on Reco mountain near here, has been bonded to C. F. Caldwell and others of Spokane for $100,000. The mine is opened by tunnels.

On the tenth level of the Silversmith mine there has been developed an orebody 100 ft. long, 100 ft. high, and 8 ft. wide, valued at $900,000. This mine has produced over $3,000,000 in lead, silver, and zinc.

Ontario

Boston Creek.—The Renaud claims, near the Miller-Independence gold mine, has been acquired by Robert Warrington for Detroit people. Several promising veins are said to have been opened. S. Renaud is in charge.

The Northern Ontario Light & Power Co. is arranging to supply current to the Boston Creek field.

Cobalt.—The Mining Corporation of Canada has its pumping plant ready for collecting the sand and slime from the bed of Cobalt Lake. The machinery consists of two 8-in. pumps, driven by 100 and 125-hp. motors. Their combined capacity is from 1000 to 1200 tons daily. The old residue is to be re-treated in the mill. The process will be, classifying, tube-milling, concentration, flotation of the sand, and cyaniding the slime. The material contains several ounces of silver per ton.

Silver produced by the Nipissing company in July was worth $304,694. This was extracted from 172 tons of high and 7058 tons of low-grade ores. The refinery shipped 842,870 oz., including custom metal.

The Buffalo Mines Co. is to reduce its capital from $750,000 to $500,000, by distributing $250,000. This is the second time that this has been done, the original capital being $1,000,000. Total dividends, including the proposed amortization distribution, will total $3,287,000.

The Kerr Lake mine produced 231,000 oz. of silver in July, well above the average for the year so far.

Porcupine.—The Davidson Gold Mines' report for 1917 shows that $86,138 was spent in development. Equipment is valued at $50,269. There was 3096 ft. of new work done, also 1181 ft. of diamond-drilling. Surface work disclosed good veins. On the 100-ft. level 11 ft. of $35 ore was opened in 1918. Reserves are 30,000 tons of $20, 10,000 tons of $15, and 100,000 tons of $7 ore, a total of $1,450,000. The new 60-ton mill is now in operation.

PHILIPPINE ISLANDS

The Philippine Dredging Co.'s results last year were as follows, compared with the previous period:

	1915-'16		1916-'17	
Dredge	Cubic yards	Gold, oz.	Cubic yards	Gold, oz.
No. 1	224,787	1,428	408,721	2,013
No. 2	835,986	11,426	717,089	8,340
No. 3	442,945	5,250	445,983	4,913
No. 4	524,170	3,126	626,460	2,559
	2,027,888	21,230	2,198,253	17,825

A dividend of 24c. per share was paid, and part of the debentures were paid off. This company has an interest in the Paracale dredging company, operating No. 1 and 3 boats under an arrangement.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Horace V. Winchell is at Salt Lake City.

Frank Walker, of Butte, is at the Whitcomb hotel.

J. K. Turner, of Goldfield, is at the St. Francis hotel.

A. G. Cadogan has gone to Los Acostos, in Pinar del Rio, Cuba.

James F. Kemp is taking part, as geologic expert, in the litigation at Bingham.

A. H. Jones, metallurgist for the Tonopah Belmont Development Co., is here.

S. M. Morse & Co., consulting engineers, have opened an office at Phoenix, Arizona.

Harlowe Hardinge has obtained a commission as Captain in the U. S. Radio Service.

W. W. Wishon is in Montana examining mines for Los Angeles and Montana clients.

James S. Douglas was in San Francisco this week, on his way from Arizona to Manitoba.

H. M. Strouss, mine superintendent for the Atolia Mining Co., at Atolia, has moved to Alameda.

S. F. Shaw has returned to Charcas, San Luis Potosi, Mexico, from San Antonio, Texas.

Arthur K. Adams is in the Engineer Officers Training Camp, at Camp Humphreys, Virginia.

Augustus D. Ledoux, not his brother **Albert R. Ledoux**, is chairman of the Chemical Alliance Committee.

Magnus Poulsen, engineer-in-chief to the Societe Belge Industrielle et Miniere du Katanga, is at Neuilly, France.

Sidney L. Shonts, of Wallace, Idaho, has been appointed a mining engineer in the Service of the U. S. Bureau of Mines.

C. A. Atkinson, general superintendent at the Cerro de Pasco smelter, sailed from Lima, Peru, for the United States on July 25.

Samuel W. Cohen, vice-president of the Bluestone Mining & Smelting Co., was in San Francisco recently, and has now returned to Montreal.

Forest Rutherford is making an examination of mines in Colorado and will attend the Colorado meeting of the American Institute of Mining Engineers.

W. E. Carpenter, mechanical engineer for the Anaconda Copper Mining Co., has been appointed to a similar position in the service of the Consolidated Arizona Mining Co., at Humboldt, Arizona.

T. A. Stiles, recently in charge of the construction of the United Verde Extension smelter, near Jerome, Arizona, will leave shortly for Oroya, in Peru, to build a large reduction plant in that country.

A Mining Circle has been formed at El Paso, Texas, with the following committee: **H. J. Baron**, chairman; **E. F. Knotts**, secretary, with **Leonard Worcester, E. S. Plumb, Harry Anderson**, and **J. J. Ormsbee. S. H. Worrell**, of the Texas School of Mines, and **J. A. Krakauer** are ex-officio members.

O. D. Rohlfs, formerly of the Original Amador mine, has been appointed superintendent of the Treasure mine near Amador City, California, succeeding **Charles Bell**, who resigned to accept a position in Nevada. **E. M. Herberger**, assayer and accountant at the Original Amador, has accepted a similar position at the Treasure mine.

THE METAL MARKET

METAL PRICES

San Francisco, August 27

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

ORE PRICES

August 27

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$24

Chrome production of the United States in the first half of 1918 amounted to 26,000 tons, according to the U. S. Geological Survey. This averaged 40% Cr_2O_3, and is equal to 20,800 tons of 50% grade, the standard of calculation. Mining during this period was unfavorable until April, but at the present rate of output the year should yield 52,000 to 60,000 tons of 50% ore. Labor and transportation difficulties are much improved, and are being further bettered.

EASTERN METAL MARKET

(By wire from New York)

August 27.—Copper is unchanged but strong. Lead is acutely scarce. Spelter is strong and higher.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 49½ pence.

Date	New York, cents	London, pence
Aug. 21	101.12	48.81
" 22	101.12	48.81
" 23	101.12	48.81
" 24	101.12	48.81
" 25 Sunday		
" 26	101.12	48.81
" 27	101.12	48.81

Average week ending	
July 16	99.62
" 23	99.62
" 30	99.62
Aug. 6	99.62
" 13	99.62
" 20	100.25
" 27	101.12

Monthly averages

	1916	1917	1918
Jan.	56.76	75.14	88.72
Feb.	56.74	77.54	85.79
Mch.	57.89	74.13	88.11
Apr.	64.37	72.51	95.35
May	74.27	74.61	99.50
June	65.04	76.44	99.50
July	63.06	78.92	99.62
Aug.	66.07	85.40	....
Sept.	68.51	100.73	....
Oct.	67.86	87.38	....
Nov.	71.60	85.97	....
Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date	
Aug. 21	26.00
" 22	26.00
" 23	26.00
" 24	26.00
" 25 Sunday	
" 26	26.00
" 27	26.00

Average week ending	
July 16	26.00
" 23	26.00
" 30	26.00
Aug. 6	26.00
" 13	26.00
" 20	26.00
" 27	26.00

Monthly averages

	1916	1917	1918
Jan.	24.30	29.53	23.50
Feb.	26.62	34.57	23.50
Mch.	26.65	36.00	23.50
Apr.	28.02	33.16	23.50
May	29.02	31.69	23.50
June	27.47	32.57	23.50
July	25.66	29.67	26.00
Aug.	27.03	27.42	....
Sept.	28.28	25.11	....
Oct.	28.50	23.50	....
Nov.	31.95	23.50	....
Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
Aug. 21	9.00
" 22	9.12
" 23	9.12
" 24	9.25
" 25 Sunday	
" 26	9.25
" 27	9.25

Average week ending	
July 16	8.78
" 23	8.68
" 30	8.45
Aug. 6	8.37
" 13	8.37
" 20	8.60
" 27	9.16

Monthly averages

	1916	1917	1918
Jan.	18.21	9.75	7.87
Feb.	19.99	10.45	7.97
Mch.	18.40	10.78	7.67
Apr.	18.62	10.20	7.04
May	16.01	9.41	7.29
June	12.85	9.63	7.92
July	9.90	8.98	8.72
Aug.	9.03	8.58	....
Sept.	9.18	8.33	....
Oct.	9.92	8.32	....
Nov.	11.81	7.76	....
Dec.	11.26	7.84	....

Zinc-ore prices are better at Joplin, Missouri. The base price advanced last week from $47.50 to $52.50 per ton for 60% product.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date	
Aug. 21	8.05
" 22	8.05
" 23	8.05
" 24	8.05
" 25 Sunday	
" 26	8.05
" 27	8.05

Average week ending	
July 16	8.05
" 23	8.05
" 30	8.05
Aug. 6	8.05
" 13	8.05
" 20	8.05
" 27	8.05

Monthly averages

	1916	1917	1918
Jan.	5.95	7.64	6.85
Feb.	6.23	9.10	7.07
Mch.	7.26	10.07	7.26
Apr.	7.70	9.38	6.99
May	7.38	10.29	6.88
June	6.88	11.74	7.58
July	6.40	10.93	8.03
Aug.	6.28	10.75	....
Sept.	6.86	9.07	....
Oct.	7.02	6.97	....
Nov.	7.07	6.38	....
Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date	
July 30	120.00
Aug. 6	120.00
" 13	120.00
" 20	120.00
" 27	120.00

Monthly averages

	1916	1917	1918
Jan.	222.00	81.00	128.06
Feb.	295.00	126.25	118.00
Mch.	219.00	113.75	112.00
Apr.	141.60	114.50	115.00
May	90.00	104.00	110.00
June	74.70	85.50	112.00
July	81.20	102.00	120.00
Aug.	74.50	115.00	....
Sept.	75.00	112.00	....
Oct.	78.20	102.00	....
Nov.	79.50	102.50	....
Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918
Jan.	41.76	44.10	85.13
Feb.	42.60	51.47	85.00
Mch.	50.50	54.27	85.00
Apr.	51.49	55.63	88.53
May	49.10	63.21	100.01
June	42.07	61.93	91.00
July	38.37	62.60	93.00
Aug.	38.88	62.53	....
Sept.	36.66	61.54	....
Oct.	41.10	62.24	....
Nov.	44.12	74.18	....
Dec.	42.55	85.00	....

Freight-Rates on Manganese Ore

On August 20 the Director General of Railroads ordered a general reduction in rates on manganese ore. The new carload rates, per ton of 2000 lb., with a minimum carload weight of 60,000 lb., follow:

From stations in	Group D (a)	Group 2 (b)	Group B and C (c)	Group A (d)
Oregon	$11.00	$12.50	$12.50	$15.50
Washington	11.00	12.50	12.50	13.50
California	11.00	12.00	12.50	13.50
Montana	8.00	9.50	9.50	10.50
Arizona	9.00	9.00	10.50	11.50
Colorado	7.00	7.00	8.50	9.50
Nevada	10.00	11.00	11.50	12.50
Utah	9.00	10.00	10.50	11.50
New Mexico	7.00	7.00	8.50	9.50

(a) Group D—Chicago, Indiana Harbor, and Erie.

(b) Group 2—Points in Alabama and Tennessee taking group C rates.

(c) Group B and C—Youngstown, Pittsburgh, Buffalo, and points in Ohio.

(d) Group A—Points in seaboard territory, including Goshen, Graham, Reusens, and Roanoke, Virginia.

The War Trade Board states that the list of restricted imports No. 1 has been so far modified as to permit the importation from Japan of 2,000,000 gal. of creosote during the remainder of the present calendar year.

Eastern Metal Market

New York, August 21.

Strength and quietness pervade practically all the markets, some being a little more active than others.

Demand for copper is heavy, now that the price has been definitely established for a period.

Tin has been quiet and is still scarce but offerings have been more liberal.

Lead is extremely scarce, with an apparent relief in sight.

Zinc is stronger and higher on better demand and limited offerings.

Antimony has advanced.

In the steel industry the output is still limited by the lack of coal and coke. An adequate labor supply, under the conditions that are to result from the new draft, is a serious problem. As to new iron and steel capacity there is not so much concern at Washington as anxiety to get a full-capacity output from existing units. The pig-iron shortage grows more acute, a situation that has obtained for months. Scrap shortage is added to the pig-iron scarcity, both tending to keep down the steel output. If existing capacity could be properly fed with raw materials, the output of steel ingots could be larger by 3,000,000 to 4,000,000 tons. For our forces in France 20,000 more cars have been bought.

COPPER

The most interesting news in the copper market, aside from the fact that buying for delivery up to November 1 has been extremely heavy since the price was settled for the period between August 15 and that date at 26c. per lb., unchanged, has been the suggestion by Director McAdoo that the railroads of the country be electrified wherever possible, and as soon as possible, as a war measure to save fuel. Copper as wire, and in other shapes, to carry out such a project would be large in amount and would exert a distinct influence on the market. Buying for delivery of copper beyond November 1 is possible only at the price obtaining after that date. It is stated that the output of crude copper is falling off, due to poor labor and to some inability to fill up the leaks. It is certain that the unprecedented hot weather in the New York district the past two weeks has interfered with the output of refined metal for over 90% is purified in this district. As to whether there will be copper enough to meet all demands is a disputed question, which only time will answer. Jobbers are permitted to ask 27.35c. per lb. for 5-ton lots and less.

TIN

Buyers continue to absent themselves from the market, and as a result the situation is uninteresting and quiet. There are two reasons for the lack of interest on the part of consumers: They are apparently fully covered by old purchases, and they desire to await the outcome of the meeting in London of American representatives with British tin interests. There is no news yet as to development from this conference, but, whatever they do, it is felt that a better understanding will result, with perhaps some simplification of the permit and license regulations. In the past week there have been more liberal offerings for shipment from the Far East, and October shipment from the Straits can be secured at 81c. per lb. This compares with about 84 to 85c. per lb. a few weeks ago, and with 97c. at the peak of the upward movement two or three months ago. A little business was done, but only a little. Arrivals of tin at Atlantic ports to August 15 have been 2320 tons and those at Pacific ports to August 17 inclusive, 3175 tons. Spot Straits in London was lower again yesterday at £377 10s., as against £387 10s. the week before.

LEAD

The scarcity of lead continues more pronounced, if it were possible, than a week ago. In fact lead producers, through their own committee, are continually exercising more control over the situation. It is now nearly impossible to obtain lead except by applying to this lead committee. The lead situation is quite similar to the tin in that it is practically impossible to buy it. The opinion is expressed that it may not be long before all lead consumers will have to furnish the Lead Committee with full particulars as to their requirements so as to relieve supplies in the order of their importance. Because some dealers have been receiving as high as 8.75c. per lb., New York, for lead urgently desired, it is understood that they have been or soon will be required to take only ½c. per lb. or 8.55c., New York, above the agreed price, otherwise their supplies may be restricted.

ZINC

In the past week the zinc market has developed a decidedly stronger tone and prices have advanced almost daily. One cause for this, or perhaps the inception of the upward movement, was the purchase last week of 3000 tons of grade D zinc by the Government. This is practically prime Western grade. Supporting influences have been the limited amount of offerings, and the shrinkage of stocks, as shown by the Government statistics now published weekly. According to these, stocks of grade D have been reduced 9000 tons in the last six weeks. Should the rate of decrease be maintained for six weeks more the surplus must be wiped out entirely. Prime Western zinc for August-September delivery is now quoted at 8.87½c., St. Louis, or 9.12½c., New York, with the likelihood that 9c., St. Louis, or 9.25c., New York, would be paid quite easily. A 9c. market is looked for in a day or so. For fourth quarter 8.85c., St. Louis, has been bid, and 8.90 to 8.95c. per lb. asked. Demand from consumers is reported as very good.

ANTIMONY

The market has advanced as a result of a better demand, both for early and future delivery, and is now quoted at 13.75 to 14c. per lb., duty paid, New York.

ORES

Ferro-manganese: Sales of about 1300 tons of domestic alloy have been made at $250 per ton, delivered, for 70%, with only $3.50 per unit above or below this standard, instead of $4 per unit, the former level. The market is not active.

Ferro-silicon: The Carnegie Steel Co., Pittsburgh, is making 50% ferro-silicon in its Duquesne plant, and will also make its own electrodes. It is not known whether the output of ferro-silicon will meet the needs of the company, which is the largest consumer in the country. For delivery this year, in small lots, $170 at the plant is obtained. One producer is making 10 to 12% alloy in an electric furnace, low in phosphorus, and obtaining $95 per ton at the furnace for it.

Molybdenum: Prices are nominal at $1 per lb. of MoS_2 in 90% material, buyers showing no interest.

Tungsten: High-grade ore has advanced if anything, due to a more active market. Some high-grade ore has sold as high as $25.50 with good wolframite going at $24.50 per unit in 60% concentrate. Low-grade ores command $20 per unit up. Ferro-tungsten is quiet at $2.30 to $2.45 per lb. of contained tungsten, one seller asking the latter level.

Book Reviews

Business Law. A working manual of every-day law. By Thomas Conyngton, assisted by Elizabeth A. Smart. Pp. 535, index. The Ronald Press Co., New York, 1918. For sale by 'Mining and Scientific Press'. Price, $4.

The principal points in this work that should be of value to mining and engineering companies are: the fundamentals of law, contracts, sales, fire and life insurance, employer's responsibility, corporations and their directors, taxation, arbitration, and the advisability of litigation. If an engineer considers these points a moment, he will admit that most of his troubles come under these heads. Law in its modern manifestations cannot be studied without some reference to economics and sociology. A few years ago, the latter factor was given little consideration, now it is all-important. This new book is not technical, the law in each case being concisely explained, so readers should be able to derive some advice from the examples given.

Elements of Electrical Engineering. By William S. Franklin and William Esty. Volume II. Alternating Currents. Pp. 408. Ill., index. The Macmillan Co., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $3.50.

As the title-page states, this is a text-book for technical schools and colleges. Few engineers in other lines than electrical work will care to make as much of a study of the subject as this book would require nor is it likely that the practising electrical engineer will care to have it as a reference book. For the purpose for which it was intended, however, the book is entirely satisfactory. Some of the chapter-headings are: The Alternator, Alternating Current Measurements, Harmonic Electromotive Force, Complex Quantity, the Polyphase System, Voltage and Voltage Regulation, the Synchronous Motor, the Transformer, the Induction Motor, the Single-Phase Series Motor, Switchboards, and Transmission Lines. The book is well illustrated and the authors have done their best to explain a difficult subject.

A Handbook on Piping. By Carl L. Svensen. Pp. 359, ill., 8 folding plates, index. D. Van Nostrand Co., New York, 1917. For sale by 'Mining and Scientific Press'. Price, $4.

The only means of conveying air, gas, and fluids is by means of continuous pipe; we may neglect gases under high pressure stored in pipes or cylinders as being of comparatively little importance. Wood pipe, in the shape of bamboo, has been used in the Orient for centuries. Wood pipe, made from logs, has been used for over 200 years. Welded-iron pipe has been in use since early in the nineteenth century. From then onward came cast-iron, earthenware, concrete, brass, copper, lead, steel, wood, and other types of pipe. These all have their particular use, whether it be for steam, gas, oil, or acid. Ordinary iron or steel pipe is very strong, resisting great strains before breaking. Another use for pipe is that of hand-rails and guards for machinery. A great length of threaded pipe can be laid in a short time, jointing being simple. With cast-iron pipe joints require extra time. Wood pipe, if of the stave type, also requires more care, but has great endurance. Many fittings have been designed for the jointing, expansion, and change of direction in pipe, also many valves. Tools for the cutting, threading, bending, and jointing of pipe are generally simple and few. Steam pipe requires insulating to prevent radiation; and water pipe requires covering deep in the ground to prevent freezing. All of the points enumerated above, and many others, are discussed in this practical treatise. We fail to find mention of pipe for acid, important, yet of little significance when compared with the extensive use of pipe for other purposes. Any engineer having a pipe problem on hand should find help in this useful handbook.

Second Annual Report of the State Oil and Gas Supervisor of California. Pp. 404. Ill., index. California State Mining Bureau, San Francisco.

The first part of this report is a so-called 'letter of transmittal' of 121 pages, and includes a general discussion of the work of the department, a copy of the law establishing the department, township-plats showing the area assessed for the work, and several brief discussions of special problems of oilfield development. Then follow separate reports by the four deputy supervisors on the work in their departments, including a summary of decisions rendered. A directory of oil companies and operators, together with brief information regarding capitalization and number of producing wells, is included. The report is nominally for the fiscal year 1916-1917, but some parts of the report have been brought up to December 1, 1917, while the data in the directory is corrected to December 31, 1916. While the delay in publication was presumably unavoidable, it is unfortunate that all parts of the report were not brought to approximately the same date. However, the report, like its predecessor, will be of great value to those interested in any branch of the oil industry.

Principles of Iron Founding. By Richard Moldenke. Pp. 494. Ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $4.

This is probably the most complete book upon the subject that has appeared in English. After a brief historical introduction the industrial and financial status of the foundry is considered, together with foundry organization and management. The next chapter deals with the metallurgy of iron and the effect of the various impurities upon it. The various processes for making both wrought and cast-iron are then considered. The next chapter discusses the properties of cast-iron, after which the various kinds and the recommended composition of each are discussed. Foundry raw materials including metals, fuels, fluxes, refractories, facing and parting materials, and core-binders are then considered. The next chapters deal with the technology of combustion and with melting processes. Then comes a discussion of mixture-making and of testing cast-iron. There is a glossary of terms and an appendix containing specifications and directions for various physical and chemical tests. The book is well-illustrated and the treatment is as nearly non-technical as is possible considering the subject.

Modern Management Applied to Construction. By Daniel J. Hauer. Pp. 187. Ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $2.50.

Although many of the investigations in connection with so-called scientific management have been made with regard to construction work, the fact remains that most construction work is not managed scientifically. This is largely because many contractors have risen from the ranks and have had, or at least have thought they had, little time for studying either technical literature or other contractors' methods. The author of the present volume, as a successful contractor, is in a favorable position to show the advantages of scientific management as applied to construction. While it is possible that in some respects his enthusiasm runs away with him, the case for study and planning is, in the main,

well stated. Financial arrangements and the choosing of construction plant are discussed. One entire chapter is devoted to shovels and shoveling to show the importance of apparently small details. Plant lay-outs and bonus systems are also considered. The book will be of value to both contractors and engineers. Its usefulness could, however, have been increased considerably by the use of a larger number of well-chosen illustrations and by the application of scientific methods of arrangement to the text of the book itself.

Ports and Terminal Facilities. By Roy S. MacElwee. Pp. 309. Ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $3.

The importance of proper terminal facilities, particularly at ports, is becoming more and more apparent. The present volume, without attempting to discuss technical details of construction, gives a general view of the entire subject. After a brief introductory chapter, the leading ports of the world and the general characteristics of a well co-ordinated seaport are described. Competition between ports for rail and maritime freight is shown to be mainly dependent on rates and they in turn on many conditions. Transfers of freight by belt-line railroads and by lighters are then discussed. The American and particularly the Western reader will be surprised at the importance given to lighters not only for transfer between vessels but also between vessels and factories, and even between factories. Drays and motor trucks are then considered, together with methods for avoiding congestion of deliveries. Piers, wharves, quays, and wharf, shed, and warehouse equipment are discussed, together with methods of handling special kinds of freight. Chapters are devoted to inland waterways, industrial-harbor development, and free ports, with particular attention to the free ports of Bremen and Hamburg. A bibliography is also given. The book is well illustrated and the treatment throughout is non-technical.

Hydraulic and Placer Mining. By E. B. Wilson. Third edition, revised. Pp. 425, ill., index. John Wiley & Sons, New York, 1918. For sale by 'Mining and Scientific Press. Price, $3.

Hydraulicking is not only used in moving gold-bearing gravel; it is also employed in stripping overburden from silver veins, as at Cobalt, Ontario; washing alluvium from other mineral deposits; leveling ground in hilly cities, as at Seattle, Washington; reclaiming coal from culm piles in Pennsylvania; and washing sand and debris into mine workings, as in the Rand and Europe. Therefore others than gold-miners should find the work of value, when it is considered from these viewpoints. The second edition appeared in 1907. Of the United States gold production, 25% is recovered by placer mining, including dredging; and of the 5300 gold and silver mines, 30% are placers, so that this form of mining is important. Before a gravel deposit can be mined, naturally a number of factors are to be considered; such as geology, prospecting and valuing, water supply, ditches, flumes, and piping, giants and nozzles, method of elevating gravel if necessary, sluice-boxes, and disposal of debris. These points are fully discussed in this book. Being essentially a work on hydraulicking, dredging is covered in a short chapter; although traction dredges and dry-placer machines—for use where water is scarce—receive attention. Methods of valuing placer ground include recent articles in the technical press. The chapter on Graphic Hydraulics will be found useful to those who have to calculate the duty of water. Some space is devoted to black-sands, which do not carry so much gold as has been stated during past years, and which could be treated if they were really valuable. Placer-mining laws and useful tables complete one of the few works on this subject. The illustrations could have been much improved by new ones from the field; however, they do not detract from the subjects discussed.

The Vaporizing of Paraffin for High-Speed Motors (Electric Ignition Type). By Edward Butler. Pp. 117. Ill., index. Charles Griffin & Co., London, and J. B. Lippincott Co., Philadelphia. Price, $1.50.

Paraffin in British usage, as most of our readers will remember, is the word applied to approximately the same distillate of petroleum that is called kerosene in America. Gasoline has become so expensive and so difficult to obtain at any price in England that the demand for a kerosene-carbureter is even more insistent than it is in America. The present volume discusses the carbureters for gasoline and the modifications necessary in order to construct a kerosene-carbureter. The author has apparently made a careful study of his subject. However, the book is so carelessly written and the style is so involved that we do not believe many persons will have the patience to dig out the facts that the text doubtless contains. A fair example of the general style is furnished by one sentence that contains 124 words, including three clauses introduced by 'which', and one by 'and this'. The book's usefulness for the American reader is further impaired by the fact that British technical terms and names for the various petroleum distillates are used entirely, and no glossary is provided. In short the book is an excellent example of what a technical treatise should not be.

Bookkeeping and Cost Accounting for Factories. By William Kent. Pp. 252, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $4.

Many engineers who have used Kent's 'Pocketbook' will be surprised to learn from the preface to the present volume that the author was a bookkeeper and cost-accountant for several years before he became an engineer, and is therefore unusually well qualified for the task he has set himself in this book. The first three elementary principles show that, by the use of the combined journal-ledger, the labor of taking a trial balance may be eliminated. The system of accounts recommended by the Federal Trade Commission is discussed and several improvements are suggested. Factory accounting is then shown to be distinct from commercial bookkeeping. The principle is stated that in the general books of a manufacturing concern the operations of the factory should be treated as if they were those of a separate business, belonging to outside persons. The author shows that the cost department should be divorced from the accounting department. Methods of cost-finding are described and distribution of burden is discussed thoroughly. Depreciation, inventory valuation, appraisals, daily and monthly records, classification, and bookkeeping by machinery are considered in turn. The latter part of the book is devoted to practical cost-accounting in various industries, including foundries, blast-furnaces, machine-shops, hardware factories, textile mills, power-plants, and printing-shops. The book will be of great value both to the engineer and the cost-accountant.

RECENT PUBLICATIONS

Manganiferous-Iron Ores of the Cuyuna Range, Minnesota. By Edmund Newton. Pp. 126, maps. Bulletin 3 of University of Minnesota, Minneapolis, 1918.

Slag Viscosity Tables for Blast-Furnace Work. By A. L. Field and P. H. Royster. Pp. 35. Technical Paper 187 of U. S. Bureau of Mines, Washington, 1918.

Company Reports

CALUMET & ARIZONA MINING CO.

Property: copper mines at Warren and smelter at Douglas, Arizona; also control of the New Cornelia mines at Ajo, and the Tucson, Cornelia, and Gila Bend railroad to Ajo; and an option on the Gadsden copper mine at Jerome.

Operating Officials: J. C. Greenway, general manager; L. D. Ricketts, acting; W. B. Gohring, superintendent of mines; H. A. Clark, smelter superintendent; M. Curley, general superintendent of New Cornelia.

Financial Statement: during 1917 income totaled $20,035,866, of which $19,513,033 was from metals. Operations cost $9,358,213, plus $2,157,947 for State and Federal taxes, and $1,891,205 for ore depletion and depreciation. The net income was therefore $6,628,501. Investments at cost, including $789,000 of Liberty Bonds, total $6,673,538. Other assets are $3,243,203 of notes receivable, $1,081,034 supplies, $2,186,007 cash, $2,954,657 metals on hand and in process, and $271,472 of sundries. Current liabilities total $2,189,984. The railroad earned a profit of $98,140.

Dividends: in 1917 there was paid $10 per share, equal to $6,424,762, and a special of $1, or $642,479. The total since 1903 is $98 per share, amounting to $35,992,762.

Development: labor troubles in the second half of the year hindered operations considerably. There was 98,161 ft. of new work accomplished. Generally, results on the deeper levels of the Oliver, Cole, Junction, and Briggs shafts were good. Nothing has been done to the new Campbell shaft since the strike. Water pumped amounts to 1900 gal. per min. from the 1800-ft. level, and 1500 gal. from 1500 ft., a total of 3400 gal. In 1916 this was 3580 gal. A new 1488-gal. duplex double-acting plunger-pump is now working at 1800 ft. in the Junction. It is driven by a 1000-hp. direct connected motor. This machine is of new design, having no gears or speed-reducing devices.

Production: 50,572 tons of high sulphur ore was shipped to outside points; 3259 tons of manganese ore was sold to steel-makers at Chicago and Birmingham; 1607 tons of lead-zinc sulphides was sold to Kansas paint-makers, and 1458 tons of lead ore was sent to El Paso. Including custom ore (295,286 tons) the two blast-furnaces reduced 585,975 tons and the four reverberatories 525,007 tons of charge. An average of 13.3 roasting-furnaces handled 451,255 tons, reducing 31.6% sulphur to 10.2%. The converters produced 48,466 tons of blister copper. Metal yield was 59,131,512 lb. copper, 906,039 oz. silver, and 27,948 oz. gold.

The acid plant started in March 1917, and produced 50,225 tons of 50°B. sulphuric acid, equal to 177 tons daily. Since October it has made 223 tons per day. Four roasters supply all the sulphur necessary.

MINING CORPORATION OF CANADA

Property: silver mines and mills at Cobalt, Ontario. Reports are given in considerable detail.

Operating Officials: D'Arcy Weatherbe, consulting engineer; C. E. Watson, manager.

Financial Statement: the revenue in 1917 totaled $3,964,494, of which $2,604,434 was operating profit. Adding the balance from 1916, interest, and dividends, there was available $5,378,405. The balance carried forward to 1918 was $3,448,378, or $1,000,000 more than that from 1916. Cash assets total $1,032,815, and current liabilities $171,306.

Dividends: four and bonuses totaled $1,556,297.

Development: there was a total of 8494 ft. of work done, and a little diamond-drilling. This makes 21 miles to date. Little work was done in the Townsite mine. Old stopes supplied broken ore. Reserves contain 257,040 oz. of silver, against 763,700 oz. a year ago. In the south workings of the Cobalt Lake mine work was stopped, but in the lower levels it was vigorously pushed to find extensions of the rich City ore-shoot and of finding ore in the Lake Fault vein. Results were disappointing. The same ground is to be explored in the upper levels. The City mine was the principal producer, and most of the ore-reserves are in the rich but intricate vein system. Reserves consist of 373 tons of ore containing 1800 oz. per ton, and 30,991 tons averaging 28 oz., a total of 1,545,370 oz., or less than half of that a year ago.

Production: 595.85 tons of shipping ore averaged 2344.66 oz. per ton, and 83,489 tons of milling ore carried 40.16 oz. per ton. The total extracted from crude ore, concentrate, and by cyanidation was 4,485,542 oz. This makes 27,614,582 oz. to date. Extraction was 94.43%, a gain of 2.29%. The ratio of ore milled to concentrate produced was 68.4 to 1.

Costs: a comparison is as under:

	Per ton		Per ounce	
Item	1917	1916	1917	1916
Mining	$2.42	$1.85	$0.0453	$0.0475
Development	0.24	0.37	0.0045	0.0094
Exploration	2.08	1.65	0.0390	0.0424
Treatment	4.57	4.12	0.0856	0.1059
Freight and realization	4.40	2.12	0.0825	0.0543
Administration, etc.	1.11	0.75	0.0209	0.0191
Royalty, taxes, etc.	4.44	2.57	0.0833	0.0660
Total	$19.26	$13.43	$0.3611	$0.3446

OLD DOMINION COMPANY

Property: the mines, mill, and smelter of the Old Dominion Copper Mining & Smelting Co., and United Globe Mines, at Globe, Arizona. Early in 1917 the Old Dominion acquired all assets of these companies, previously controlled by it.

Operating Official: W. G. McBride, general manager (formerly P. G. Beckett).

Financial Statement: from July 1, 1917, labor troubles hampered operations considerably. Income last year was $8,635,171. Expenses were $6,258,662; taxes, depreciation, etc., $1,155,244, leaving a profit fo $1,221,265. To this is added $367,586, balance from 1916; and $5,607,894, net surplus of Old Dominion C. M. & S. Co., and United Globe, making available $7,196,745. After paying dividends the surplus at December 31, 1917, was $4,820,483.

Dividends: $8 per share was paid, equal to $2,376,262, making $13,216,976 since 1905.

Development: new work amounted to 24,321 ft., against 42,018 ft. in 1916. Considerable development was done in the upper levels, but most was done with best results on No. 18, the lowest. Sinking at 3 shafts aggregated 502 ft. The west-side orebodies supplied most of the smelting ore, and the east-side bodies most of the concentrating ore. Water pumped amounted to 1,494,830,000 gal., of which 730,000,000 gal. was sold to the Miami Copper Co. The pumps are now capable of discharging 20,000,000 gal. in 24 hours. The maximum flow was 4,898,393 gal. on March 12, and minimum 3,466,620 gal. on December 31, the latter the same as in 1916.

Production: the mill dressed 199,575 tons of 3.78% ore, recovering 88.01% at a cost of $1.254 per ton, against 254,213 tons, 3.89%, 86.63%, and $1.142 per ton in 1916. Flotation saved 30.54% of the total. The smelter reduced 198,548 tons of charge, costing $3.134 per ton, compared with 271,367 tons and $2.793 per ton in 1916. Converting cost $8.96 per ton of fine copper, a gain of $1.37. The metal output (including custom metal) was 32,365,795 lb. copper, 165,703 oz. silver, and 3898 oz. gold.

Magnesium production of the United States in 1917 was 115,800 lb., against 116,938 lb. in the first half of 1918. The American Magnesium, Norton Laboratories, and Rumford Metal companies in the East make this powder.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

HULETT EXCAVATOR FOR COPPER LEACH-TAILING AT AJO

By Franklin Moeller

*Considering the short time that has elapsed since hydrometallurgical processes of extracting copper from its ores have been extensively developed, and the large scale on which this method is practised at Ajo, the successful operation of the plant must excite the admiration of every visitor. The application of the mechanical unloader at Ajo is but an extension of the use for which it was originally designed, some 20 years ago, for unloading iron-ore vessels at the lower Lake ports. At a time when the maximum output of a single machine, with men shoveling the ore into buckets, did not exceed 40 tons per hour, G. H. Hulett invented and constructed a mechanical unloader with a bucket of 10-ton capacity. This machine was of the steam-hydraulic type, and it is still in operation after nearly 20 years of service. Several more machines of the same type were built, but the difficulties of power transmission, and the rapid development of electrical machinery, soon led to the adoption of electrically operated machines, and practically all of the later installations have been thus equipped. This electrically-operated unloader has proved so well fitted for the work that the design of the Lake boats has been practically revolutionized, with respect to the ease and rapidity of unloading. It is now possible to unload a 12,000-ton vessel with four machines in a little over 2 hours. The largest machine yet built handles an average of 17 tons, with a possible maximum of 20 to 21 tons.

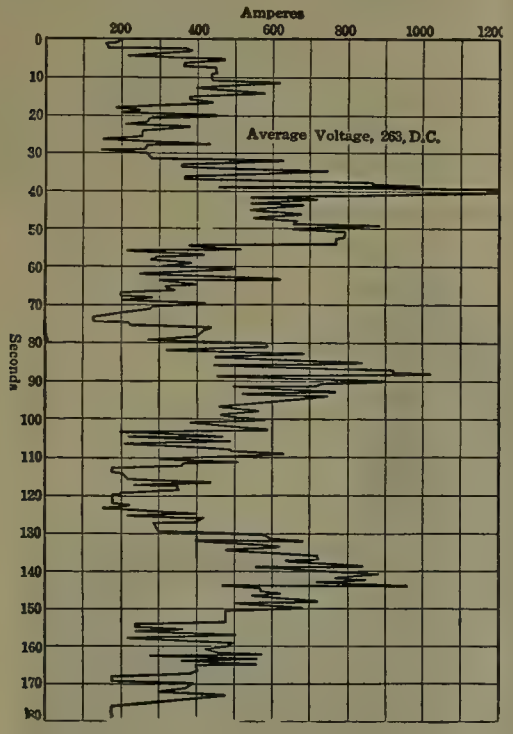
'THE BIG BEETLE'; HULETT TAILING-EXCAVATOR AT NEW CORNELIA COPPER LEACHING PLANT, AJO, ARIZONA

The excavator at Ajo is somewhat simpler in design than the iron-ore unloader, in that it is not provided with a larry.

*Abstract: 'The Tailing Excavator at the Plant of the New Cornelia Copper Co., Ajo, Arizona,' Trans. A. I. M. E., to be read at the Institute meeting, September 1918.

In the unloader the iron ore, grabbed by the bucket, is delivered to a larry or transfer-car which runs in the lower chord of the bridge; the larry then delivers the ore either into railroad cars, standing on several parallel tracks, or into the stock-pile, thereby saving the time that would be required for the bucket to make the trip. At Ajo, the bucket delivers the tailing directly into cars, and as the distance is short, the capacity of the machine is limited only by the regularity with which the cars can be supplied.

The leaching-tanks from which the tailing is to be removed are 12 in number, arranged in two parallel rows.



POWER DEMANDS OF EXCAVATOR DURING THREE MINUTES

Each tank is 88 ft. (26.8 m.) square, and, when filled to a depth of 14 ft. 6 in. (4.42 m.), holds 5000 tons of ore; one tank is emptied each day. The excavator has a span of 106 ft., just sufficient to clear the buttresses on both sides of the tanks. Beyond the bridge runway, on one side of each set of tanks, are the railroad tracks for the cars, which convey the tailing to the dump. To move the excavator from one row of tanks to the other, a transfer table is provided, having a runway at right angles to the bridge-runway of the excavator. The excavator cansists essentially of four parts, namely, the bridge, the trolley, the walking-beam, and the bucket. The bucket is of the two-part type, and each shell is given a considerable sliding action during the closing movement, thus acting as a hoe, and ensuring a more nearly complete filling of the bucket when approaching the bottom of the pile. When open, the distance between the cutting edges of the shells is over 20 ft. (6 m.). The shells are U-shaped, without back-closing piece, so that the bucket can always be closed without choking. The opening and closing chains are attached to cam-shaped drums, rotated by gearing and rope-drum set in the vertical leg to which the bucket is attached. The bucket can be rotated about the axis of the bucket leg through an arc of about 325° in either direction, and as the centre of the bucket is offset about 2 ft. from the centre of the bucket-leg, it can clean up, in any given position, a space 24 ft. (7 m.) in diameter. The driving mechanisms for all the bucket-movements are on the end of the walking-beam opposite to that where the bucket-leg and bucket are attached. The mechanism for raising and lowering the bucket is also placed in the walking-beam.

The use of the walking-beam has several advantages; it provides a ready means for balancing the weight of the bucket; it eliminates the hinged cantilever of the bridge; and its length can be adjusted to suit special requirements. In order to ensure vertical movement of the bucket the bucket-leg is fitted with parallel rods. The forward or bucket-end of the walking-beam is not entirely balanced, and the downward movement of the bucket is due to gravity, but always under control of the operator. A solenoid brake on the motor holds the bucket in any position. The main trolley, to which the walking-beam is pivoted, is mounted on two 6-wheel spring-bearing trucks set immediately under the pivot posts. The rear end of the extended trolley is fitted with upper and under-running wheels to prevent this end of the trolley from lifting. The trolley is moved by a rack and pinion, operated by a motor-driven mechanism, and is supported on a moving bridge, both legs of which are mounted on two four-wheel equalizing spring-bearing trucks, one of each set being provided with driving-gears. The wheels are double flanged, and the trucks have ball-and-socket connections to allow for full equalization. One of the trucks is also provided with an expansion-bearing to permit the bridge structure to adjust itself to inequalities of the track gauge. Power is applied to the trucks in the customary manner, the motor for driving the bridge being set in its lower chord. All of the movements of the bucket are controlled from one point by a single operator, who rides in the bucket-leg, immediately above the bucket. He can thus maneuvre the bucket with perfect accuracy and assure the maximum output of the machine. One movement, that of the bridge, is not controlled from the bucket-leg, but the operating levers for it are so placed that they can be reached by the operator when near the middle of the bridge. An assistant looks after oiling, etc. Altogether about 500 hp. of direct-current motors are required. Safety appliances are provided. The machine will handle 500 tons of tailing per hour, which is equivalent to a bucketful every 72 seconds.

To avoid injuring the bottom of the tanks, the tailing is removed only to within 6 in. (15 cm.) of the bottom. Men are then sent down to shovel the remainder into windrows so that at the next excavation the greater portion of this tailing will be removed. The tailing is delivered into 20-ton cars, running on a track parallel to the line of the tanks, and the operators become so adept in manipulating the discharge of the bucket that practically nothing is spilled outside of the cars or back into the tanks. The actual amount of current required per ton of material is extremely low, and the accompanying chart gives a clear picture of the power demands. It frequently happens that the operator combines the closing, lifting, and traveling movements, and by doing so creates a heavy peak-demand. It is interesting to note how the cost of discharging ore has been cut by improved methods. When steam-hoists were first used, the total cost was 40 to 50c. per ton. With the introduction of the bridge-system, this was reduced to 18 to 20c. per ton, and with the present type from 4 to 5½c. per ton.

The transfer-table is of simple construction, consisting of two 8-wheel trucks connected by a steel structure, and operated by an 80-hp. motor, giving the table a speed of 75 ft. per minute. The transfer table is fitted with latches to ensure proper registering of the table tracks with the excavator tracks, and its movements are controlled from a cab placed on the table.

[The Hulett excavator described is manufactured at Cleveland, Ohio, by the Wellman-Seaver-Morgan Co.—Editor.]

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AN INDEPENDENT PAPER OWNED, EDITED, AND MANAGED BY ENGINEERS

Announcing——

The Crowe Vacuum Precipitation Process

This process is the invention of Thomas B. Crowe, Metallurgist of The Portland Gold Mining Company, of Colorado Springs, Colorado. Broad patents have been granted covering the use of the process, both in the United States of America and in foreign countries. These patents are now owned by the Merrill Metallurgical Company.

The Crowe Process has now been in use for upwards of two years, and has definitely passed the experimental stage. The results obtained in a number of plants, under widely varying conditions, warrant our belief that this process constitutes the most important single improvement in precipitation practice since the early days of the cyanide process.

The process is now in operation, handling the entire solution tonnage, at the following large plants:

The Homestake Mining Company	3 plants
The Portland Gold Mining Company	2 plants
The Golden Cycle Mining & Reduction Company	1 plant
The Tonopah Belmont Development Co	1 plant
The United Eastern Mining Company	1 plant
The Elko Prince Leasing Company	1 plant

The process is also being installed by the following companies in Mexico and South America:

Cia. de Real del Monte y Pachuca	2 plants
Cia. de Minas La Blanca y Anexas	1 plant
The Esperanza Mining Company	1 plant
The Mexico Mines of El Oro	1 plant
The Alvarado Mining & Milling Company	1 plant
The South American Development Co	1 plant

Deliveries of the necessary equipment can be made practically from stock, and the installation is a matter of a few days without interruption of regular operations.

The Crowe Process is particularly adapted for use in conjunction with the Merrill Precipitation Process, or with the standard zinc shavings boxes. With either system, a substantial saving in zinc, and particularly in cyanide, will be effected. The process is equally applicable to small as well as to large plants, since practically no power is required and very little supervision is necessary.

We are prepared to submit full details of equipment and to quote prices for the use of the process.

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In This Issue:

Condensing Quicksilver From Furnace-Gases
Flotation Flow-Sheets

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Advertisers' Index, Page 66

Screenless Classification
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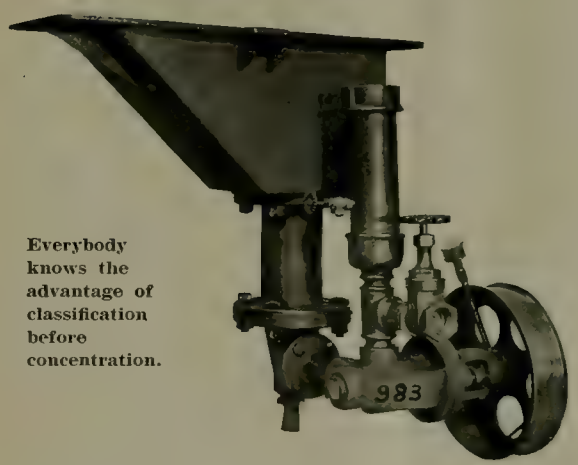

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EDITORIAL STAFF

T. A. RICKARD, Editor
COURTENAY DE KALB, Associate Editor
M. W. von BERNEWITZ, Assistant Editor

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BUSINESS STAFF:

C. T. HUTCHINSON, Manager
E. H. LESLIE, 600 Fisher Bdg., Chicago
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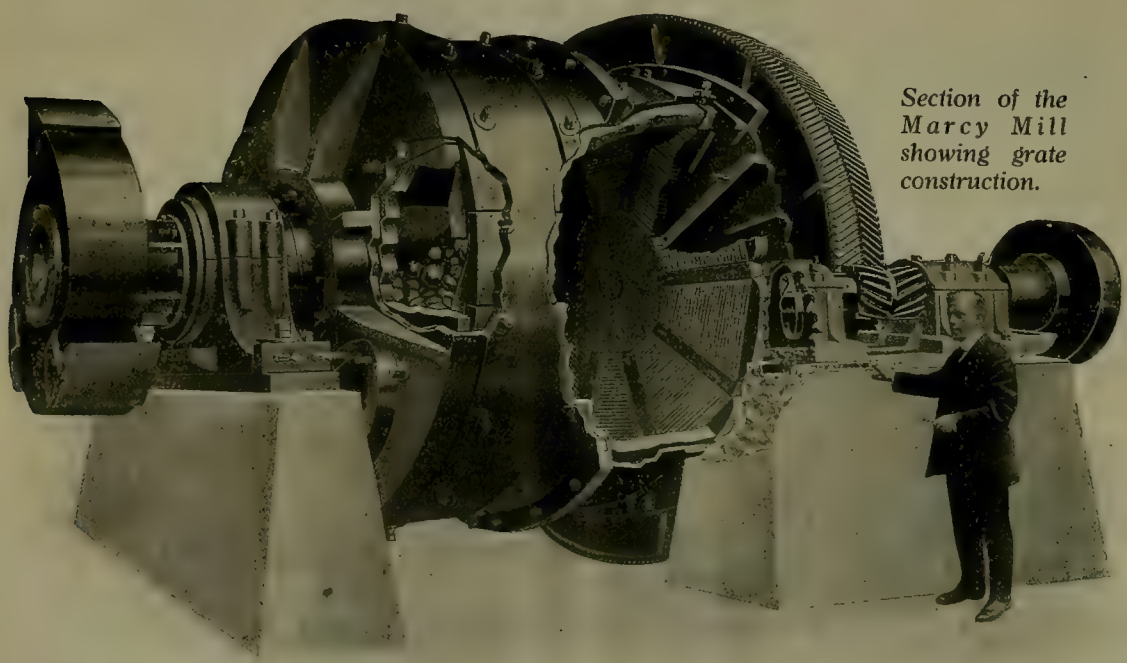

Section of the Marcy Mill showing grate construction.

IN this issue we publish an article on the condensation of quicksilver from the gases coming from the furnaces in which mercurial ore is roasted. The article is by Messrs. L. H. Duschak and C. N. Schuette, of the U. S. Bureau of Mines; it exhibits both skill in research and care in writing; therefore we are glad to give it to our readers.

SIR ROBERT BORDEN, the Canadian Premier, on his return from Europe, where he had again visited the battle-line, delivered the following message from the Canadian army overseas to the people of the Dominion: "Stand fast to your purpose, abide the issue, and vindicate the cause of justice and humanity." These words find a ready echo in the hearts of each of the Allied peoples. We must stand fast to the end and beware of the poisonous gas of premature peace proposals.

THE resignation of Mr. H. L. Carnahan, as State Commissioner of Corporations, is announced. Charges of political intrigue have been exchanged between the Governor and the Commissioner, who received a peremptory order to get out of office. Whatever the cause of the quarrel, we regret the loss of a thoroughly capable official, who was doing splendid work in checking chicanery in mining finance, as in other applications of company promotion to the industrial development of California.

OFTEN we have endeavored to establish a distinction between 'investment' and 'speculation.' Others have done so. For example, a gentleman in the State of Washington signing himself M. E. states that a certain mining venture is "an investment, NOT A SPECULATION," and he uses small caps just like that. He says: "A 1000-stamp mill could not exhaust it in a hundred years. With its billions of tons of ore of a uniform grade piled thousands of feet high between sharp ends and clean-cut walls that show no sign of the disturbance since the subsidence of the force that placed it there, without a break or a fault apparent in the entire length of it, and considering that it is in OUR OWN STATE OF WASHINGTON, within one day's journey of Seattle, instead of in some far off and inaccessible mountain fastness, or across the bleak and wind-swept tundra in the frozen land of the North. This property should be one that would interest the most conservative as well as those looking for a speculation." Yet he assures the possessor of surplus cash that it is "not a speculation." We agree: it looks like a damned certainty.

EVERY day brings its casualty list. We read the list and are grateful if we find no name to cause a pang of personal sorrow. We may feel glad of that, but then there comes the reminder that in the list are men equally good having friends as dear to them as our own kinsmen are to us. We share the sorrow of others and realize that these splendid young fellows have died for our cause, for us. If we remain at home, immune from the risk of life and limb in battle, it remains for us to back their effort and to show appreciation of their supreme sacrifice by making the much smaller sacrifice of contributing cheerfully to the campaign for Liberty bonds. They have fought victoriously against the Enemy, it is for us to make the next Liberty Loan a testimonial to their prowess.

ALASKA GOLD made a loss of $14,247 on the 309,249 tons milled during the quarter ending June 30. The tonnage milled was 1821 per day less than in the preceding quarter. The mill-feed assayed $1.16 per ton, as compared with 99c. in the first quarter of the current year. The mine is "seriously hampered," says Mr. Charles Hayden, the president of the company, "by the lack of competent labor and the steadily increasing cost of supplies"—which is true, but this mining enterprise is handicapped most of all by the lack of sufficient gold in the rock that is being exploited in the hope of gain. Mr. Hayden expresses a hope that the Government may afford some relief to the gold-mining industry in the near future and thereby help the Alaska Gold out of a bottomless hole. As the thing now stands, the Alaska Gold is a benefactor—not to its shareholders or bondholders—but to the Nation, for it is producing a necessary product at a loss to itself. The Alaska Gold Mines Company deserves a halo.

LABOR DAY had unusual significance this year, for the parades placed emphasis on the fact that the workingman was giving solid support to the cause of humanity in the great contest against militaristic slavery. Two incidents provoke particular satisfaction: Mr. Samuel Gompers, as the official representative of organized labor in the United States, received the right hand

of welcome from the British Premier, Mr. Lloyd George, on the day that W. D. Haywood and his fellow-conspirators of the I. W. W. were committed to prison under heavy sentences for breaking the law in their anti-social effort to impede the draft and to sow dissension among the ignorant. The War has had the effect of arousing public opinion in every class against unpatriotic utterance or act, thereby giving force to the law against sedition however disguised. Labor has joined with capital, the employee with the employer, in resenting any attempt to oppose the national will in the intention to win this war and to prevent the recurrence of another similar outrage against humanity.

LEST we forget, it is well to make note of the manner in which the Germans in a submarine treated the crew and passengers of the French steamer 'Lydiana' off the coast of Spain on July 16, as reported a few days ago. The 'Lydiana' was not a warship, but she was torpedoed without warning, several of her crew being killed forthwith. While a boat was being lowered a second torpedo was fired, tearing the boat from the davits but failing to sink her. Seeing this, the captain of the submarine used his murderous craft to ram the boat, cutting her in two and drowning most of those in her. Having accomplished this, the German went for a second boat, which had been launched successfully, and rammed her also, killing the captain of the 'Lydiana' and hurling a young girl into the air so violently as to kill her likewise. The murderous performance was not yet completed, for the German tried to sink a raft carrying the remaining survivors. When one of them, a ship's officer, left the raft and endeavored to swim back to the sinking 'Lydiana', the submarine was turned so as to kill him by its propellers. Then, raking the 'Lydiana' once more, so that she sank, the Germans made a sixth and successful attempt to ram the raft, amid the laughter of the U-boat's captain and crew. Eight men were saved by a patrol boat and lived to tell the story—a story thoroughly characteristic of German chivalry. Such stories, when authentic, must be kept in mind when the Enemy begins to whine for peace. What treaty of peace could we make with such a beast? What assurance for the future could we obtain from a military caste having no sense of honor? The only safety for the future of civilization lies in such punishment, including invasion, as shall cause the German people to unhorse the Hohenzollern dynasty and also to cause the German people themselves to resolve never again to try to dominate the world.

TARTARIN looked at Sonia, the pretty Russian nihilist, and could not believe that her little hand, so slender in its chamois glove, had displayed the courage to kill a man. Here is the contradiction of the lingering tiger that on occasion overcomes the spirit of peoples in their training to observe the decencies of law. Lenine was probably as unwilling as the famous Gascon of Daudet's clever imagination to believe that the pretty hand of a Russian 'intellectual' could deal a bolt of death. To clear the Russian air of Lenine, were not outside influences at work, would be like eliminating the dark cloud of Marat from the France of the Revolution, so that constructive forces might begin to build a nation out of a liberated canaille. Russian women are not unaccustomed to acts of violence, yet the seeming parallel to Charlotte Corday cannot fail to strike the observer and prompt the question how far the similitude may carry. We would feel more convinced of a rising healthy sense of the indignity imposed upon Russia by the Bolshevist conspiracy with Germany if a Russian mob had driven the traitorous Lenine across the border into the country of his employers. It is hard to foresee what the downfall of Lenine and Trotzky may betide. It might be the signal for the restoration of the moderate Socialists who are said to see hope of support for the landowners against the self-assertive peasants by working in harmony with Germany. There is peril in this possibility, just as there is peril in the Teutonic policy of inciting jealousies between rival Russian local governments. A united Russia would be a menace to Germany, and it is seen how cleverly the separatist movements have been fostered by the Prussian managers. Bolshevism was the necessary preliminary form of spurious pacifist patriotism to let down the national tension from a state of actual war, but it was also manifest that a firmer order, under a land-holding class, so subdued by the riotous proletariat as to welcome even German aid for its preservation, would be the next instrument that the Teutons would wish to use. We fear that Charlotte Corday after all may not prove to be re-incarnate in Russia.

The I. W. W. Convictions

Bolshevism in America received a stinging blow when Haywood and 14 other leaders of the I. W. W. organization were sentenced to 20 years in the Federal penitentiary by Judge Landis at Chicago after a trial by jury that ended on August 30. Besides these, 80 others were sentenced to shorter terms of imprisonment, together with the imposition of fines ranging from $20,000 on Haywood and the other ringleaders to $5000 on the lesser agitators. The combined concurrent sentences of the 95 I. W. Ws make a total amounting to 807 years and their fines to $3,130,000. It remains to be seen whether the judgment of the Court will be reversed in a new trial, but if it be justified by the evidence, as it seems to be, we hope it will stand as a warning against the attempt to destroy the democratic organism of the United States. The trial lasted 128 days, the accused were well defended, they received the justice to which they were entitled. The four counts of the indictment included charges of conspiracy to thwart the national prosecution of the War, to interfere with the production of material needed for the War, to obstruct the enforcement of the draft, and to violate the espionage law. The Judge laid stress on the I. W. W. preamble declaring eternal hostility to the employing class, on the action of the executive board in expelling members that had entered military service, and on the concerted plan to in-

cite strikes and sabotage with a view to impeding the Government in waging war. Among those sentenced are several identified with the worst outrages that have marked labor disorders in the mining districts of the West, notably W. D. Haywood and Vincent St. John, whose names recall the strikes at Cripple Creek, Telluride, Butte, and Wardner in years gone-by, and, ineradicably, the assassinations of Arthur L. Collins in 1904 and of Governor Steunenberg of Idaho in 1908. The trial has proved the I. W. W. organization to be not only anti-social in time of peace but traitorous in time of war. It is to be hoped that the infamy stamped upon this Bolshevist organization will prevent it forever from exerting any further influence among workingmen in the United States and will prevent them from ever again being terrorized into participation with the political incendiarism of a gang of outspoken criminals. The evidence at the trial showed how large a part sabotage plays in the methods of terrorism used by the I. W. W. They tried it against the Government in time of war and thereby invited the merciful punishment of an outraged democracy—in any non-democratic country they would have seen their last sunrise long ago. We note that the Socialist party has been impelled to wash its hands of them; it was high time to do so, for the I. W. W. is not socialistic in any sense, it is anti-social; it is as much opposed to a socialistic organization of society as to any other; it is purely and maliciously destructive, like the criminal idiots that have brought the Russian revolution from a hopeful success to a miserable fiasco, from intelligent reformation to political chaos and industrial collapse. There is no more room for the Bolshevist idea in the United States than there is for the Prussian; the effort to destroy all social order is as repugnant to the American as the attempt to create a militaristic tyranny. We shall fight the Bolshevist at home as relentlessly as the Prussian abroad, and it is well that we fight the one with the left hand while we use the right hand against the other, for each is equally the foe of democracy. The Prussian and the Bolshevist alike are the enemies of representative government and of that ordered way of living we call civilization.

The Function of Gold

Discussion concerning the possible salvation of the gold-mining industry continues with unabated vigor. It will receive fresh impetus at the meeting of the Northwest Mining Association to be held at Spokane on September 5. It is a question of paramount importance, fully meriting the serious consideration it is receiving, and we are gratified to see that the organs of the banking and financial interests are giving as much attention to it as are the representatives of the mining industry. The 'Commercial and Financial Chronicle' reproduces the resolutions adopted by the American Gold Conference at Reno, with approval of its declaration for sound money and an undisturbed unit-measure of value. It is fair to assume that the problem of producing more gold will be discussed by the American Bankers' Association at its annual convention at Chicago on September 23. The August bulletin of the Federal Reserve Board has brought the issue strongly before the country in terms that involve a conscious interlocking of the interests of the bankers and the gold-producers. It says: "Ever since the establishment of Federal Reserve banks, the Board has endeavored by every legitimate means to increase the aggregate gold holdings of the banks. . . . Of late the Board has received questions from various quarters respecting the reasons of theory supporting the course which it has urged with respect to gold. The situation in this regard is perfectly plain. In proportion as the gold holdings of the Federal Reserve banks are increased, the ability of such banks to extend accommodation to other banks, or to issue notes, is enlarged. Taking 40% in gold as normally required as a minimum behind every note that is issued, it is clear that, in order to lend $100 in Federal Reserve notes, a Federal Reserve bank must have on hand in its vaults, or with a Federal Reserve agent, $40 in gold. In proportion as its reserve holdings are curtailed, its lending power is correspondingly reduced. Some question also has been raised with reference to the practice of hoarding gold. Every dollar of gold that is hoarded is withdrawn not only from reserve use but also from circulation. It is a net loss of that amount of metal to the community. The effect of its concealment is, therefore, to remove the possibility of providing the strongest possible gold-cover for our growing volume of bank-notes and deposits. The desirable conditions, under existing circumstances, is to have every dollar of gold in the Federal Reserve banks, while the circulating medium consists of currency based on gold. Money of every kind, whether gold or silver, should be deposited in bank and used, but not hoarded. Surrender of gold coin and gold certificates, and abstention from hoarding, means an increase in the volume of bank-credit available for the community, and an increased ability to finance its war and other requirements." An extension of this doctrine is contained in the circular issued by the Federal Reserve Bank of San Francisco on August 1, where it is affirmed: "Gold in possession of a member bank or of an individual serves no necessary purpose which other forms of money would not serve, but in the possession of a Federal Reserve bank it gives financial protection to the country as surely as an army gives physical protection. To draw soldiers from the Army or to keep them from the Army to perform services that others could perform, would weaken our physical defense and invite disaster. Likewise to hold gold out of the reserve of the Federal Reserve banks weakens our financial defence and invites financial disaster. . . . The increasing demand upon the Federal Reserve Bank is shown by the fact that although the amount of the gold reserve has increased over $31,000,000 (in the three-month period ending June 30) the proportion of gold to liabilities has decreased approximately 1%." These authoritative statements show conclusively the important function of new gold in sustaining the national credit. Our margin of protection to issued currency is

ample at the present time, but it is declining. In finance, as in war, the rule for success is initiative, but initiative is unavailing without numbers. Even Napoleon confessed that the victories he had scored with forces inferior to those of his enemies had been won by maneuvers that enabled him to beat them, division by division, in detail. A decline in the volume-ratio of gold to liabilities, in the face of large accessions to the reserve, is a cogent argument for sustaining the production of new gold. Gold that is available but not produced is a more serious economic waste than coin that is hoarded. The miser with his hidden coffer dries up some of the lubricant in the journal-boxes of commerce; it is as if a part of the oil had leaked away so that the oiling-rings could not pick up enough to reduce the friction. The gold mine that is closed, however, presents the additional stress of lost homes, lost markets, lost capital, and the sacrifice of the potential value of equipment through the ravages of rust and the vandalism that cannot be repressed when plants are idle. A great reservoir of energy is suffered to waste its power when gold that might be used is left in hiding, whether in the mine or in the pocket of the timid hoarder. It is possible for the banker to definitely estimate this loss. Some affirm that the total expansive effort of gold in facilitating commercial movement is in the ratio of one to seven. We see that, in the case of the Federal Reserve, its direct ratio of expansion, or energy-ratio, as we might call it, is as forty to one hundred, or 2:5. By authority of the British government, we understand, the ratio in England has been advanced to 5. This, however, is but a fraction of the power residing in the gold price-measuring unit. The Federal Reserve Bank is an equalizer to take up the strains when the pressure of demand for credit becomes too great upon the commercial banks of the country. It is the safety-valve for the relief, not of the whole pressure, but of the margin of excess over the proper working-strain. The commercial credits, based on securities representing potential production but not active capital, are in the last analysis founded on a safe admissible credit-expansion of the gold reserve. Thus even the gold that may be in circulation is performing a feeble and barbaric service compared with its harnessed power in the delicate mechanism of refined finance. Each ounce must be regarded as something more than so much token-metal with which to purchase so many bushels of wheat; it is like the water that, on being converted into steam, develops enormous power compared with the potential energy that the original volume may have possessed by virtue of its elevation above the sea-level. Gold in the hands of the individual, in the vaults of a trust company, or in the unmined quartz of the mine, is just so much gold, a metal, ductile, dense, brilliant, and beautiful, for which men normally will exchange no more wool than for a certain equivalent face-value of National Bank notes; put it in the Federal Reserve and it becomes converted into an elastic medium that expands, some tell us even twenty times its unit-value, to drive the engines of commerce. The latent energy in an ounce of gold is independent of human effort and the consumption of ordinary commodities involved in putting it into the Treasury. This is touching a delicate and perhaps the most important feature of the present economic position. The monetary unit is the regulator; it makes no difference in our individual wealth whether we suddenly multiply all prices of commodities and labor by ten or divide them by two; the relative status of the individual as a purchaser of personal comforts or of investment securities would remain unaltered. Whatever be the factor, or however we apply it to prices, if it affect them all, our arbitrary, or whimsical, or phychologic re-appraisal of commodities in terms of our customary unit will in time be re-adjusted by the normal relations of supply and demand in terms of that same unit, and will be brought again close to the normal average level. It is essential, in viewing this question with special reference to ways and means for promoting the continuous production of new gold, to keep clear the distinction between price and cost. This has been stated in a striking manner by a distinguished economist of a past generation, J. E. Cairnes, who wrote a luminous essay 'On the Gold Question,' which then perturbed the world on account of the overwhelming Australian production. He said: "Why is the price of labor so high in Australia? The answer is, because the cost of gold is so low; the rate of money wages, as we have seen, always rising and falling as the facilities of producing gold increase or diminish; which shows, by the way, the absurdity of attempting to measure the cost of gold, as some writers have done, by the pecuniary outlay necessary to its production. The fact is that this (so far as gold is the money employed) scarcely ever varies; the gold price of producing gold representing merely the ratio of the outlay to the return, or the rate of profit, so that if the price be taken as the criterion of cost, the cost of gold would never vary unless so far as the rate of profit varies. The reader must observe that by 'cost' is meant the real difficulty involved in the production of a commodity, not the amount of money necessary to renumerate the labor by which this difficulty is overcome. The only commodity of which the 'cost' was affected by the gold discoveries was gold; but the 'price' of producing everything was altered." For us, at this moment of serious decline in gold production, the chief lesson from all this is that the gold standard is our datum line, the mean tide-level of the sea of commercial relations, which remains fixed regardless of flood or drought, but the gold is also more than a standard: it has potential energy, when so placed as to work for the whole people instead of a few, enabling the people through their Treasury to extend to the miner a portion of that credit into which his gold can be expanded, to meet the cost of the necessaries for production. Thus his rate of profit may be maintained so as to make the operation of his mine remunerative, and he will furnish the substance of the elastic credits required in war finance without altering the size of the gold-measure of value. It was on this principle that the American Gold Conference wisely pronounced in favor of an unchanged monetary standard, while seeking pecuniary relief. We believe that the gentlemen at Spokane will endorse that position.

Platinum at Grand Canyon

The Editor:

Sir—As your editorial of June 15, regarding platinum at Grand Canyon, Arizona, might be interpreted as reflecting injuriously upon my integrity as a mining geologist, I ask you to publish the following statement of facts:

I have been engaged by the United States Platinum Co. to examine its properties at Indian Gardens, Grand Canyon, Arizona, and I have accepted this engagement with the express provisions that I should have an absolutely free hand to ascertain the truth and to give my conclusions to the public. As to references to a report on this property by me, I wish to state that I have never written any report on that property. The prospectus mentioned was prepared and published entirely without my knowledge and I have only recently succeeded in securing a copy. Accordingly, neither its statements nor its publication has received my approval. I am now on the ground examining this property. When I have secured facts which warrant final conclusions, I shall give out those conclusions, whatever they may be, for the information of the public. JOHN M. BOUTWELL.

Grand Canyon, Arizona, August 16.

Future Gold and Silver Output

The Editor:

Sir—In April 1918 the Walsh-Pittman Bill passed by Congress authorized the treasurer of the United States to withdraw 350,000,000 silver dollars from the Treasury to provide 270,000,000 ounces of silver to be used for settling foreign-trade balances and to furnish metal for smaller coins for ourselves and our Allies.

In these days of bond-issues totaling three to six billion dollars at a single issue, 270,000,000 ounces of silver or units of any other commodity seem like a trifle; in fact, we have become so used to figuring in billions that a few odd millions seem like car-fare.

But few people have a proper conception of what the production of 270,000,000 oz. of silver costs in terms of time and labor, so that the following figures are interesting at this time, when much talk is heard about the future of silver and about increasing the value of gold and silver. The figures are taken from various publications of the U. S. Geological Survey and reports by the Director of the Mint and are approximately correct.

In 1916, Colorado produced 7,500,000 oz. of silver. At this rate of production, it would take Colorado 36 years to produce 270,000,000 oz. In the same year, the production of the United States was about 75,000,000 oz. At this rate it would take our total production for 3.6 years to replace the 270,000,000 oz. in the Treasury. In 1916 it was estimated that about 33,000,000 oz., or nearly half of the silver produced, went into industrial consumption in the United States.

During the past five years, the world's production of silver has shown a decided decrease in quantity. This year it will be lower than at any time since 1880. The consumption is exceeding production, hence the United States government must draw on the only large stock of silver in existence, to meet the emergency created by war conditions.

This 270,000,000 oz. of silver was laid by in the days of plenty; it represents the savings or surplus of years of plenty, and the labor of thousands of men. To replace it from new production may be more of an undertaking than one would think. The days of plenty for silver have gone forever, and if our Government, or any other government, ever accumulates a similar amount of silver, it will be at a far greater cost in time and labor, and certainly at a greater cost in dollars and cents.

The following ten counties in Colorado have had some fame as producers of silver, but, from the time of discovery to the present, they have produced but little more than the amount authorized to be taken from the Treasury. They may possibly produce as much more, but it will be at a considerably increased cost per ounce, and from ores of far lower grade than have been mined heretofore.

Approximate Silver Production of Ten Counties in Colorado

County	Oz.
Pitkin	93,000,000
Clear Creek	55,000,000
Mineral	42,000,000
Ouray	36,000,000
San Juan	26,000,000
Dolores	12,000,000
Gilpin	10,000,000
Boulder	6,700,000
Custer	6,000,000
Hinsdale	5,000,000
Total	291,700,000

It has taken the work of thousands of men during 40 years to produce 291,000,000 oz. of silver. Does anyone familiar with the mining industry venture to claim that there are ten more districts like them that remain undiscovered in Colorado?

Congress authorizes the withdrawal of 270,000,000 oz. of silver from the Treasury, with the understanding that this amount will later be replaced, and this is but a trifle less than the total silver production of ten of the silver-mining districts of the world.

Lake county, which contains Leadville, the greatest silver district in Colorado, if not in the world, has produced about 225,000,000 oz. in the last forty years. It will take more than another Leadville and Creede combined to replace this 270,000,000 oz. of silver in the Treasury, and where will another Leadville or Creede be found?

The Comstock lode in Nevada, discovered in 1859, has produced about 223,000,000 oz. of silver, which is 47,000,000 oz. less than the amount Congress authorizes the Treasurer to withdraw from the vaults of the Treasury, yet the Comstock lode has been called the world's greatest silver deposit, and mining men the world over are pretty well agreed that its like will never again be found. In 59 years the labor of thousands of men did not produce what Congress authorizes the Treasurer to withdraw from the vaults, a part of which has already been melted and sold for far less than it can be replaced.

At the time of discovery of either the Comstock or of Leadville, one man with a pick and shovel, and a fairly strong back, could, and in quite a number of instances did, take out several tons of ore per day that would carry 500 to 1000 oz. of silver. There is probably no place in the world where this could be done today. The cost of production was probably the lowest ever attained.

Our future supply of silver must come from the low-grade mines, and from mines of the baser metals that produce silver as a by-product. These do not produce enough to fill the requirements, so that any increase in supply must come from the old silver mines and from lower-grade ores than any heretofore worked; and, to enable these mines to produce at a profit, silver must bring a higher price per ounce than at present.

Metallurgical processes have made great advancement during the last ten years, and further improvements of processes may still be made, but it is doubtful if the grade of ore that can be handled at a profit will be materially lowered. In treating ore it is not the number of ounces or pounds of a metal contained that is the vital factor, but it is the value of the ounces or pounds. By increasing the value of an ounce of gold and silver, millions of tons of the low-grade ores in the mines of the West will become of commercial value. Without an increase of value for the gold and silver content of these ores, they will remain a dormant asset, and might as well be so much barren rock.

If an increased quantity of gold and silver is wanted and needed to bolster up our national credit and that of our Allies, there is but one way to get it; that is, to increase the value of the ounce of gold and silver to the miner. If this is not done at once, there will be an enormous loss in the quantity produced in the next two years, and after that a continued falling off in production at a more gradual rate, for many years, as numbers of mines are today consuming reserves and doing no development. When the reserves are gone the mine is gone.

Mining today is more a matter of dollars and cents than ever before and unless it can be demonstrated that there is a reasonable chance to make a profit, it will be impossible to work low-grade ores. There is going to be an enormous demand for money after the War to enable our manufacturers to expand their foreign trade. If we are to expand our foreign trade, mining must compete with the demand for money to finance this expansion, and capital is going into the business that seems to promise the greatest chances for profit. New industries have sprung up during the War and will be in the market in competition for money with the gold and silver mining industries. Mining will have to be made a more profitable business in the future than it has been in the past to compete in the money market of the future.

There is another valid reason why, at this time, the value per ounce of both gold and silver should be increased to the miner for all future production. The West has been drained of the money in buying Liberty Bonds and War Savings Stamps; also in a large proportion of the money donated to the Red Cross and Y. M. C. A. The West has not held back on any of the drives, but has generously over-subscribed. This money has been spent mostly in the East and the enormous demand for financing new war-industries has kept it there. We of the West are furnishing probably less than 2% of the manufactured war requirements, so that there is no way in which our proportion of this money can be put back into circulation in the West, unless it be by an increased price to the miner for our gold and silver production. It has always been noted in the West that when the mining was prosperous, every other industry was prosperous.

An increased price for both gold and silver would, beyond all doubt, furnish a large increase in the number of ounces produced and serve to make a more equitable distribution of the money; also it will aid in the establishing of manufacturing in the West far more than any other steps that can be taken, and it is a recognized fact today that our manufacturing centres are concentrated too extensively in the East, which fact was mainly responsible for the coal tie-up last winter, and is one of the principal reasons for the serious outlook for the distribution of coal through the industrial centres of the East for the coming winter.

Silver certainly must and will advance in price. There is no valid reason why a bonus should not be paid for the gold produced from now on. Certainly, if an increased quantity of these metals is wanted, they will of necessity be made worth the miner's time to produce them, otherwise the miner will go into a more profitable business.

The palmy days of Leadville, the Comstock, Aspen, Creede, Cripple Creek, and the Mother Lode are gone, and the sooner the general public realizes the fact, the sooner it will see the necessity for an increased price for these metals, and the better for the future of the mining industry. Had the general public understood the situation as regards silver, I doubt very much if Congress would have ventured to authorize the sale of 270,000,000 oz. at less than the cost of replacement.

Mining is as legitimate a business as any other and is entitled to as much consideration. It has not had it.

Denver, August 21. M. T. CHESTNUT, JR.

Flotation Flow-Sheets

By ALGERNON DEL MAR

In flotation flow-sheets of various mills that I recently presented,* one, two, and three cells, or groups of cells, were in use as cleaners or roughers. From the operator's point of view the correct flow of the pulp is second only in importance to the right manipulation of the oils, hence I am giving additional illustrations, so that the operator who has not had time to work out his particular problem satisfactorily may perhaps see a way to change the flow, following the suggestion here shown. The

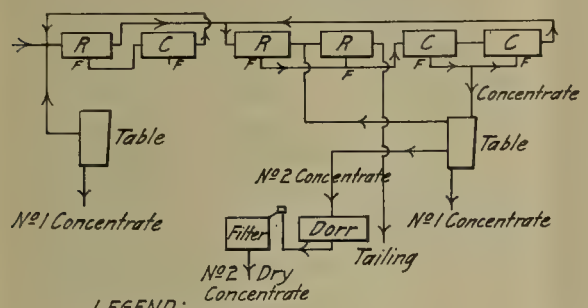

FIG. 1

number and size of cleaners and roughers necessary for the maximum efficiency is in great part determined by the amount of mineral in the pulp and by its readiness to respond to flotation treatment. A small quantity of sulphides that resist flotation, or that do not readily separate from the other sulphides, may require one cleaner cell, or group of cells, and two or three roughers, while another ore with a fair proportion of sulphides may require two to four cleaners to two roughers. Having determined this point, the problem is to pass the pulp through roughers and cleaners in such a way that the sulphides recovered are of a marketable grade and loss in the tailing is held low. The cleaner may precede the rougher or the rougher may precede the cleaner. If there is only one rougher in the system the cleaner should come first, because if the rougher is first and the machine be out of order from lack of proper feed, the rougher-tailing, which goes to waste, would carry an appreciable quantity of mineral, whereas if the cleaner were used first the pulp would have to pass through both cleaner and rougher. Where two or more roughers are in the system, the roughers should preferably precede the cleaners, for the mineral has greater chances

*'Mining and Scientific Press,' February 16, 1918.

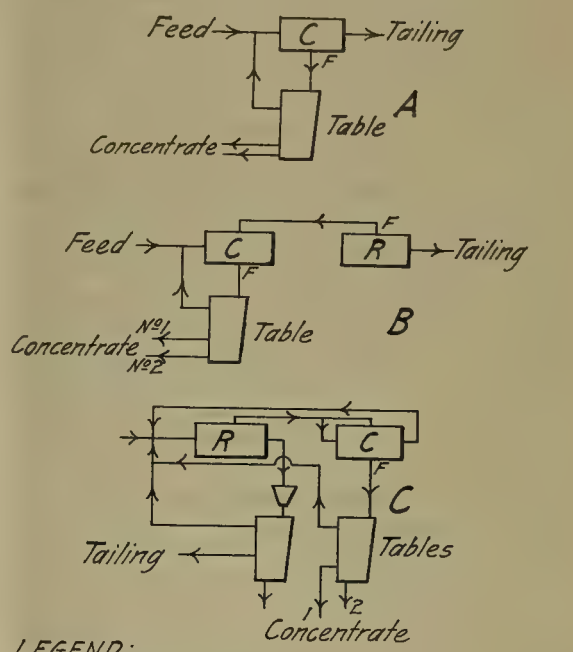

FIG. 2

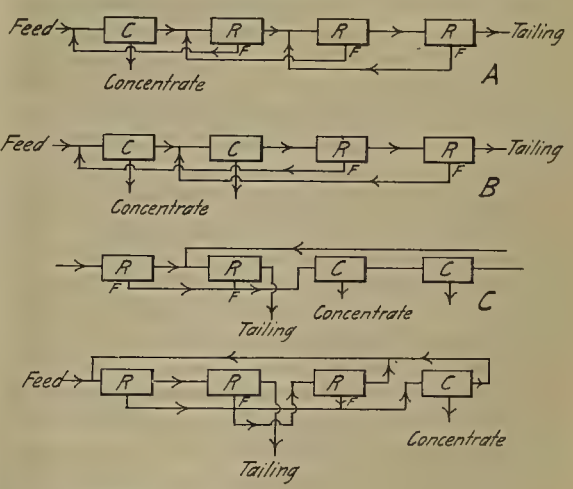

FIG. 3

of recovery before being cleaned, and the tailing from the cleaner is again passed through the rougher. Where two or three roughers precede the cleaner it is unlikely that more than one rougher will be out of order at one time, so the pulp may pass through one machine without proper treatment, but receive proper treatment in the next, but should all the roughers be out of order, say from defective power-requirement, means should be provided to cut out the flotation-feed and run the roughers in a closed circuit until good running-conditions are restored.

In speaking of 'roughers' and 'cleaners', either one cell or a group of cells is implied; for example, we may have a one-cell K. & K. machine or a group of M. S. cells. The four examples in Fig. 1 show flow-sheets with one or two cleaners and two or three roughers. *A* is a counter-current group, in which the pulp travels in a direct line, while the concentrate is returned to the preceding cell, being enriched until finally taken off the first or cleaner cell. *B* shows the same idea with two cleaners. *C* is a well-arranged and popular flow-sheet with two cleaners and two roughers, a variation of which is to send the last cleaner-tailing to the first rougher instead of to the second. *D* embodies the same idea with a single cleaner, and is a good combination for small quantities of sulphides that require preferential separation in the rougher cells.

A concentrating table in a flotation flow-sheet may answer one or all the following purposes:

1. Breaking of froth.
2. Separation of one or more minerals from the concentrate.
3. Taking the place of another flotation-cell by dividing the concentrate into a marketable product and another product that is to be returned to the flotation cells for re-concentration.
4. Recovering oil for re-use.

In the flow-sheets Fig. 2, *A* is a single-cell cleaner, where the concentrate is tabled, the reject being returned to the flotation-cell. From the fact that in this system the pulp is passed but once through the machine it would appear that a table is a necessary adjunct of a one-cell system. In *B* we have a cleaner and a rougher, the table acting in the same capacity as in No. 1, that is, to break the froth. The reject from the table might preferably go to the rougher-cell, because it contains an excessive amount of moisture and a thin pulp would harm good work in a cleaner-cell, while in the rougher-cell the amount of moisture in the pulp is not so important. *C* shows two tables, one after the cleaner and one after the rougher. The latter will recover what concentrate may escape the rougher when this is not working satisfactorily, and likewise return the excess of oil for re-use. The table after the cleaner answers the same purpose as in *A* and *B*. Sometimes it is not practicable to float a commercial grade of concentrate, in which case it may be necessary to re-concentrate on a table and reject that part of the table-concentrate which is not saleable and not return it to the system at all. For example, a flotation concentrate may be so impregnated with iron that the concentrate is not marketable. This iron may be separated on a table and rejected, making a commercial product of the remaining mineral or minerals.

In Fig. 3 is given a flow-sheet where two different minerals are separated by the flotation process, the one most readily raised being treated first, the tailing then going to other cells for the separation of another mineral. It will be observed that this flow-sheet is a combination of those already represented by the diagrams. In the illustration herewith, I believe I have shown the importance of selecting an appropiate flow-sheet for a pulp according to the requirements of the particular ore. It may be that it is impracticable to obtain a marketable product with a flotation-cell alone, but that a concentrating table might solve the problem if placed in the circuit at the right place.

BAUXITE exists in great quantities in India in the lateritic deposits on the west coast of the peninsula, both above and below Bombay, to a distance of 120 miles from that city, as well as at Belgaum farther to the East. Other lateritic bauxites are found in Central India in the provinces of Bihar, Orissa, Chota, Nagpur, Rewah, and Bhopal. Shortly after the outbreak of the War the Indian government entered into negotiations with the firm of Tata Bros. & Co. for the study of the problem of utilizing these ores. After detailed examinations it was decided to establish a hydro-electric plant on the river Koyna, a stream rising in the western Ghats, and flowing into the Krishna. A dam is to be built to impound the waters, since the rainfall is not well distributed throughout the year, but amounts to 20 inches during the period of the monsoons. The reservoir will cover an area of 56.8 square miles with a maximum depth of 275 ft., and will impound 21,188,400,000 cubic feet of water. The head of water at the power-house will be 565 ft., and about 350,000 hp. will be developed. This power will be used to operate a large aluminum plant, in addition to which works for the production of synthetic ammonia will be established.

ALUMINA is obtained from materials containing compounds of other metals, such as Na, K, Ca, and Mg, by converting all the metals into nitrates and heating the mixture to about 140–300°C., under reduced pressure, so as to decompose only the $Al(NO_3)_3$. The undecomposed nitrates are removed by lixiviation and may be separated or used as a fertilizer, and the nitrous oxides evolved may be converted into HNO_3. The process may be applied to plagioclase rocks, which are for this purpose treated with nitric acid. The method was devised by H. Goldschmidt, for which British patent 113,276 was granted on February 5, 1918.

MANGANESE is being mined from the Mandinga property, 70 miles east of Colon, in the Canal Zone. About 18,000 tons had been shipped to June 25. The owners are negotiating for a deposit 12 miles south of Porto Bello, on the Boqueron, a branch of the Chagres river.

Determination of Molybdenum in Ores

By WELTON J. CROOK and M. L'A. CROOK

The following methods for the analysis of molybdenum-bearing ore are the results of selecting and carefully testing methods proposed by many analysts.

Method 1: Volumetric. Titration with standard lead acetate. This method may be used either for ores or ferro-molybdenum. Fuse 0.5 to 1 gm. of the sample with 4 gm. Na_2O_2 till liquid, using a nickel crucible. Continue heating for five minutes after fusion and run the fusion up the sides of the crucible. The temperature should not have reached more than dull red heat. Extract with water in a beaker and rinse the crucible. Boil down to about 150 cc. and filter; wash with hot water and acidify the filtrate with acetic acid. Heat to boiling and titrate the colorless solution with standard lead-acetate solution, using tannic acid as an outside indicator. The end-point is reached when the brown color no longer develops. When much iron is present in the sample it is better to fuse with NaOH in the following manner: Fuse 10 gm. NaOH in a nickel crucible till a pasty mass is formed. Mix the sample with 3 gm. Na_2O_2 and carefully add the mixture in small quantities at a time. When the fusion is complete, add another 3 gm. of Na_2O_2 and conduct the fusion as before.

Standard lead-acetate solution is made as follows: Dissolve 25 gm. lead acetate in water. Add a small amount of acetic acid and dilute to 1 litre. 1 cc. of this solution will equal approximately 0.01365 gm. lead, or 0.00633 gm. molybdenum.

Standard ammonium molybdate solution: Dissolve 10 gm. of finely powdered ammonium molybdate in water. If the solution is not clear, add a few drops of NH_4OH. Dilute to 1 litre. 1 cc. of this solution will equal approximately 0.01056 gm. lead.

Tannic-acid indicator: Dissolve 0.1 gm. tannic acid in 30 cc. water. Make up fresh as required.

Standard lead sulphate for standardizing: Weigh out exactly 0.2 gm. of pure lead, dissolve in HNO_3 and evaporate nearly to dryness. Add 20 cc. H_2SO_4 and evaporate to fumes. Cool, dilute, and allow $PbSO_4$ to settle. Decant through a filter and wash twice by decantation. Dissolve the $PbSO_4$ on the filter with boiling ammonium acetate, allowing the filtrate to run into the beaker containing the bulk of the $PbSO_4$. When all the $PbSO_4$ is dissolved, titrate boiling with the standard ammonium molybdate, using the tannin indicator. The end-point is reached when a drop on the spot-plate with tannic acid gives a brown color.

Titrate the standard lead-acetate solution against the standard ammonium molybdate solution. Pipette 50 cc. standard ammonium molybdate solution into a beaker, acidify with acetic acid, and dilute to about 150 cc. Boil and titrate boiling with the standard lead-acetate solution, using the tannic acid indicator. Calculate the value of the lead-acetate solution in terms of molybdenum.

Method 2. Titration with standard lead acetate. Dissolve 2 gm. of sample in 20 cc. HNO_3, 20 cc. HCl, and 20 cc. water. After 10 or 15 minutes add 20 cc. 60% H_2SO_4 and evaporate to copious fumes. Cool, dilute, and filter off $PbSO_4$ and silicious matter. Heat the filtrate to boiling and add a few crystals of ammonium persulphate. Boil a few minutes to destroy the persulphate, cool and precipitate with H_2S for 1 hour. Boil for a few minutes and filter; wash with H_2S water. Transfer as much of the precipitate as possible back to the beaker with water. Dissolve that remaining on the paper with boiling dilute aqua regia (1 part HNO_3, 1 part HCl, and 3 parts water). Run into the beaker containing the bulk of the precipitate and boil till all is dissolved. Filter off any sulphur, add 5 cc. 60% H_2SO_4, and evaporate to white fumes. Cool, dilute to about 60 cc., neutralize with (1:1) NH_4OH till there is a distinct smell. If a white or yellowish precipitate of bismuth forms, filter. Neutralize the solution with acetic acid, add 5 gm. sodium acetate, and titrate with standard lead acetate, using tannin as in method (1).

Method 3. Volumetric. Titration with potassium permanganate. This method is useful when molybdenum and tungsten are present in the same sample. Weigh out the sample and make fusion as in method (4). Dissolve the melt in hot water, and filter. Boil the filtrate and add 20 cc. of Mdivani's reagent for each 0.15 gm. WO_3 present. The volume of the solution should be kept between 60 cc. and 300 cc. according to the amount of tungsten present. Boil for 3 minutes, filter and wash the blue precipitate with hot 5% HCl, till the filtrate gives no test for Mo when tested as follows:

If a drop of a saturated solution of mercurous nitrate, followed by from 1 to 1.5 cc. concentrated HCl and an excess of KI is added to the solution to be tested, and the mixture well shaken until the mercurous iodide at first formed is completely dissolved, the presence of Mo or W is indicated by a blue color, developed either at once or after a short time. In this way very small amounts of W may be detected. If the color is caused by Mo, it may be changed to a deep blood red by the addition of potassium thiocyanate, and even with solutions too dilute to give the blue color, an orange shade may be produced by the addition of this reagent. The orange color may be extracted with ether. If the estimation of W is required, ignite the blue precipitate in a porcelain crucible, and weigh as WO_3.

Evaporate the filtrate to a small bulk. Cool; transfer to a 25-cc. volumetric flask and dilute to the mark. Mix well and transfer 50 cc. of the solution to a beaker. Add

5 to 10 gm. sheet zinc to precipitate the tin. Allow to stand for 10 minutes. Filter and wash the residue with hot water. Heat the filtrate to 60° C., and pass through a Jones reductor in the following manner: Pass through the reductor 50 cc. 2.5% HCl, then the molybdenum solution, then 150 cc. of 2.5% HCl, and finally 150 cc. hot water. Before these solutions are passed through the reductor, charge the receiving flask with 20 cc. 10% $Fe(NH_4)(SO_4)_2$ solution and 20 cc. of 'titrating' solution. Titrate the total content of the flask with N-10 $KMnO_4$. A blank test should be run and the $KMnO_4$ consumed deducted from the main determination. The iron value of the permanganate × 0.605 gives the molybdenum.

Mdivani's reagent: 50 gm. $SnCl_2 2H_2O$ in 200 cc. concentrated HCl.

'Titrating solution': 90 gm. crystalline $MnSO_4$, 650 cc. H_2O, 175 cc. syrupy H_3PO_4, and 175 cc. concentrated H_2SO_4.

Method 4. Gravimetric, weighing as molybdenum oxide: Mix 0.3 gm. of the sample with equal parts of Na_2CO_3 and Na_2O_2, and fuse in a nickel crucible, finishing at a bright red heat. After cooling, dissolve the melt in hot water and filter. Treat the filtrate with an excess of yellow ammonium sulphide and warm on a water-bath. Add a slight excess of dilute H_2SO_4, little by little. Blow a current of air into the solution to remove the excess of H_2S. Filter the solution, wash and dry the paper, and precipitate. When dry remove as much of the precipitate as possible to a porcelain crucible; burn the filter separately, and add the ash. The molybdenum sulphide is converted to MoO_3 by heating over a small flame. The $MoO_3 \times 0.66667 = Mo$.

Method 5. Gravimetric, weighing as molybdenum sulphide: Digest 0.3 gm. of the sample with 25 cc. fuming HNO_3 for several hours, and evaporate to dryness. Treat the residue with 2 or 3 cc. H_2SO_4 and take up with 50 cc. water. Filter while warm, wash with water, with dilute NH_4OH, and again with water. Precipitate the iron and alumina in the filtrate with NH_4OH; filter, and boil the filtrate down to 150-200 cc., and add an excess of yellow ammonium sulphide. If present, filter off the precipitate of copper sulphide, add HCl, and warm the solution. Filter off the precipitate of molybdenum sulphide; evaporate the filtrate to dryness, and drive off much of the ammonium salts. After cooling, dissolve the residue in NH_4OH, and add ammonium sulphide. Filter the solution again, and add the precipitate of molybdenum sulphide to that previously obtained. Ignite the precipitates with sulphur in a current of hydrogen, and weigh as MoS_3 (or ignite to MoO_3). $MoS_3 \times 0.49946 = Mo$.

Method 6. Gravimetric, as molybdenum sulphide: This method is the one adopted by the U. S. Bureau of Mines and is used for ores containing only traces of arsenic or antimony. Digest 0.2 to 0.5 gm. of sample with 25 to 35 cc. fuming HNO_3 for 3 hours, and finally evaporate to dryness. Add 3 cc. concentrated H_2SO_4 and heat to dense fumes. Cool, dilute to 100 cc., filter and wash with water. Then wash the residue well with (1:3) NH_4OH, and finally with water. Make the filtrate ammoniacal, heat, filter, and wash well with hot water. Saturate the alkaline filtrate with H_2S to a bright cherry red color. Filter and wash with hot water. Acidify the filtrate with HCl until slightly acid and digest till the precipitate and the sulphur are well coagulated and the excess H_2S is expelled. Filter through a weighed Gooch crucible. Evaporate the filtrate to dryness in a casserole and drive off the ammonium salts at the lowest possible temperature, being careful not to heat the casserole to redness at any time. Take up the residue with 100 cc. water and 5 cc. NH_4OH, add 10 cc. ammonium sulphide, make faintly acid with HCl, and digest till the sulphide has coagulated. Filter through the Gooch crucible previously used. Add an amount of sulphur to the combined sulphides equal to about one-half their weight and ignite over a Bunsen burner at a dull red heat in a stream of arsenic-free hydrogen. The weight obtained is MoS_3.

The references below will be useful in further research upon the determination of molybdenum, whether in ores, ferro-molybdenum, or molybdenum steel.

'Molybdenum: Its Ores and Their Concentration,' F. W. Horton, U. S. Bureau of Mines, Bulletin III, 1916, p. 44. 'Rapid Method of Determining Molybdenum,' J. Darroch and C. D. Meiklejohn, 'Eng. and Min. Jour.', Nov. 3, 1906. 'Estimation of Molybdenum in Molybdenite,' E. Collett and M. Eckhardt, 'Chem. Zeit.,' 1909, v. 33, p. 968-969; also 'Chem. Soc. Abs..,' v. 96, p. 991. 'The Separation of Tungsten from Molybdenum,' E. E. Marbaker, 'J. Am. Chem. Sc.,' v. 37 (1915), p. 86-95. 'Estimation of Molybdenum in Calcium Molybdate,' W. Trautmann, Zeit. Angew, Chem., 1910, v. 23, p. 1981; also Chem. Soc. Abs., v. 98, p. 1114. 'Electrolytic Estimation of Molybdenum,' A. Fischer and J. Weise, 'Zeit. Anal. Chem.,' 1912, v. 51, p. 537-550. 'Separation of Vanadium and Molybdenum,' G. Edgar, 'Am. Jour. Sci.,' v. 25, p. 332. 'Analysis of Molybdenite,' W. Trautmann, 'Chem. Zeit.', 1909, v. 33, p. 1106-1107. 'Volumetric Estimation of Molybdenum,' E. Knecht and F. W. Stack, 'Analyst,' v. 36, p. 98-100. 'Analysis of Molybdenum Ores,' W. Westling and C. Anderson, MINING AND SCIENTIFIC PRESS, Dec. 23, 1916.

THE FOLLOWING TABLE shows the Baku oil production in 1913, 1914, 1916, and 1917, in barrels of 42 gallons. The original figures in Russian poods, published in the 'Frankfort Gazette,' were converted at the United States Geological Survey rate of 8.33 poods (crude oil) to the barrel:

Wells	1913	1914	1916	1917
Old fields, barrels	46,680,000	40,560,000	39,480,000	31,570,000
New fields, barrels	9,360,000	10,368,000	17,700,000	16,704,000
Total	56,040,000	50,928,000	57,180,000	48,704,000

GANISTER, or quartzite, used in making silica brick, showed the following output in the past three years, in the United States:

Year	Tons	Average price
1917	1,295,851	$1.04
1916	859,956	0.62
1915	429,000	0.38

Pennsylvania contributed 1,003,623 tons to the total of 1917, a gain of 49%. Wisconsin sold 222,086 tons.

Condensing Quicksilver From Furnace-Gases

By L. H. DUSCHAK and C. N. SCHUETTE

INTRODUCTION. *The magnitude of the metal losses incident to the condensation of mercury from furnace-gases has been a much-discussed question among quicksilver operators, but aside from the work of Christy[1] at New Almaden, in 1885, no study of this subject has been reported in this country. An elaborate investigation has been made by Castek[2] at the Imperial quicksilver works at Idria, in Austria. No satisfactory application of his conclusions, however, can be made to American practice, owing to the many ways in which it differs from European practice. Metal losses amounting from 30 to 40% have been suspected. Unfortunately lack of technical control in the operations has usually rendered it impossible to set even an upper limit for condenser losses by calculating the gross loss incident to the entire process of ore-treatment. Our investigation was undertaken with a view to making direct quantitative determinations of such losses.

NEW IDRIA QUICKSILVER MINING CO. As over two-thirds of the output is derived from the No. 1 furnace, this was selected for study. It is a Hüttner-Scott furnace, now commonly known as the Scott furnace, with a rated capacity of 60 tons. At present about 70 tons of fine ore and concentrate, making a charge averaging about 1.25% mercury, is treated in 24 hours. Fuel-oil of 18°B. is used, there being two burners in the main fire-box and one in the rear vapor-chamber. The fuel consumption per 24 hours is about 450 gal., or 2.6% by weight of the charge. What is here designated as the 'old' condenser system comprised the customary series of brick and stone chambers followed by eight wooden barrels, then a blower, and a side-hill flue, to the stack. Before the second series of condenser-loss determinations was made, a 'new' system was constructed which retained only the first brick condenser of the 'old' system. This is followed by a line of tile-pipe, then three large wooden tanks in series connected by wooden flues, followed by the eight wooden barrels, fan, flue, and stack of the former system. The fume-cloud leaving the stack with the 'new' system is shown in Fig. 1.

OCEANIC QUICKSILVER MINING CO. Two Scott furnaces, with a rated capacity of 50 tons each, are in use. About 90 tons of ore, carrying 0.25 to 0.3% mercury, is treated in 24 hours. Wood is used as fuel in the main fire-box only, there being no booster-fire in the rear chamber. The total fuel consumption is from 2 to 2.5 cords per day, or, roughly, 3% by weight of the charge. Each furnace is followed by a brick condenser, then a series of brick and wooden chambers, which combine into a common system leading to a side-hill flue and stack.

FIG. 1. FUME-CLOUD FROM STACK

FUME-LOSSES. A preliminary survey showed that the usual methods of sampling employed at lead and copper smelters could not be used without considerable modification, owing to the large amount of water-mist present in the stack-gases. The method here described was developed and first used at the New Idria plant in May 1917. The apparatus used is shown in Fig. 2 and Fig. 3. The gas passed successively through a glass sampling-tube, a short Liebig condenser, a water-cooled bead-tower, a Hawley[3] filter, a wash-bottle, and finally through a small gas-meter to a water-jet pump, which provided the

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The work covered by this paper was conducted by the Bureau of Mines through its Experiment Station at Berkeley, California, in co-operation with the New Idria Quicksilver Mining Co. and the Oceanic Quicksilver Mine. Part of the expense was borne by these companies, and their liberality in placing their plant facilities at our disposal has greatly assisted the work. Thanks are due to H. W. Gould, general superintendent for the New Idria Quicksilver Mining Co., and to Murray Innes, owner and manager of the Oceanic mine. Clifford G. Dennis, president of the St. Johns Mines Co., has also aided in many ways.

[1]Christy, S. B. 'Quicksilver Condensation at New Almaden, California,' Trans. A. I. M. E., Vol. XIV, p. 206.

[2]Castek, Franz. 'Berg- und Hüttenmännisches Jahrbuch der K. K. Montanistischen Hochschulen zu Leoben und Pribram,' Vol. 58, 1910, pp. 1 and 231.

[3]Hawley, F. G. 'Determination of SO_3 in Flue-Gas,' Eng. & Min. Jour., Vol. 94, 1912, p. 987.

necessary suction. The sampling-tube was of glass, 0.15 inch inner diameter, closed at the end, with an opening blown in the side close to the end. This tube was placed with the opening near the middle of the gas-stream and facing the direction of flow. The bead-tower, which followed the Liebig condenser, was of glass (1 in.) inner diameter, and 12 in. long. The upper two-thirds was occupied by solid glass beads supported on a perforated porcelain plate. It is important that this plate be notched at the edges so that liquid collecting on the beads will not be prevented, by the ascending gas-stream, from draining into the reservoir below. Both the Liebig condenser and the water-jacket to the bead-tower were supplied with ice-water or cold tap-water.

The Hawley filter was arranged in the usual way with accurately ground funnels about 3.5 inches in diameter. Soft, rather thick, filter-paper was used. It was found that a section of inner tube from a small automobile tire, placed with the smooth surface next to the glass, gave a firm and absolutely air-tight joint. The wash-bottle was charged with sodium hydroxide solution for the removal of SO_2 before the gas passed to the meter. Considerable CO_2 was no doubt absorbed also. A vertical water-manometer was interposed between the wash-bottle and the gas-meter in order to indicate the reduction in pressure below the atmospheric at which the meter operated. The gas-meter was a standard laboratory instrument made by the American Meter Co. In order to secure a steady and easily adjusted suction, a regulating device was placed in the circuit between the gas-meter and the aspirator. This consisted of a tall glass cylinder with a two-hole stopper. A moveable glass tube for admitting air passed through one hole, and the other carried a T-tube through which the meter and aspirator were connected. Thermometers were placed in the water-jacket of the bead-tower, the gas-meter, and in the stack, carrying the gases under examination.

Point of Sampling. At each plant a point in the flue-system was selected beyond which the amount of mercury recovered was negligible. At the New Idria plant samples were drawn from the 35-ft. wooden stack, a few feet above its base. At the Oceanic plant an auxiliary draft-flue, carrying hot gases from a wood-fire, enters the main three-foot flue a short distance from the stack. Samples were therefore taken from the main flue just before the juncture with the auxiliary draft-flue.

Procedure in Sampling. After the apparatus had been assembled, with the exception of the sampling-tube, the aspirator was set in operation, and by closing the in-take end of the system, a test was made to ascertain that the system was without leaks. Special care was necessary in placing the sampling-tube in the stack or flue in order to avoid contamination by the mercury which coated the interior. Error from this source was avoided by wrapping the sampling-tube in a strip of paper, which was twisted together at the end. The paper-covered tube was shoved partly into the stack or flue and the sampling tube then punched through the twisted end. In removing the sampling-tube the operation was reversed, the tube being drawn well into the paper cover, and the tube and paper then withdrawn together. After the sampling-tube was properly connected, the meter was set at zero and the taking of the sample started by closing a by-pass connected to the suction-line from the aspirator. The suction was so regulated that gas was drawn through the apparatus at the rate of approximately two litres per minute. At this rate the velocity of the gas entering the sampling-tube was roughly that of the gas-stream. In spite of the precautions for stopping the water-vapor and mist, the filter-paper gradually became damp, thus considerably increasing the resistance offered to the passage of the gas. This was in a measure off-set by increasing the suction, which, however, was limited by the fact that the moist filter-paper could not withstand a pressure of more than 4 to 4½ inches of water. The rate of sampling therefore decreased gradually, but in view of the low velocity of the flue-gases, which was less than two metres per second, and the minuteness of the fume-particles in suspension, it seems unlikely that the momentum of any appreciable number was sufficient to cause them to enter the sampling-tube except with the gas-stream. Difficulty due to dampening of the filter-paper was least when ice-water was used in the condenser and jacket of the bead-tower.

At intervals during the period of sampling, the flue-gas, meter, and water-jacket temperatures and the meter and water-manometer readings were recorded. The barometric pressure was also noted, and at least one flue-velocity determination was usually made by the method to be described. The taking of the sample was usually continued until several hundred litres of gas had been withdrawn, or until the rate fell considerably.

The efficiency of the condensing and filtering apparatus in collecting the mercury was tested by placing a second bead-tower and Hawley filter just after the first set in one of the tests. The mercury recovered from the two units was, from the first tower and filter, 0.0199 gm. and from the second tower and filter, 0.0007 gm. From this it is evident that not more than a few percentages of mercury-mist in the fume samples escaped recovery.

Preparation and Analysis of Sample. At the close of an experiment the sampling-tube, condenser-tube, bead-tower, and other parts of the apparatus, including the rubber connections, which might have collected some mercury, were carefully washed with nitric acid. Great care was exercised in this procedure to avoid 'salting' of the sample by mercury-bearing dirt. This was particularly necessary in the case of the sampling-tube, which was thoroughly cleaned on the outside before dissolving the mercury within. The glass beads were cleaned by stirring them in a beaker with hot dilute nitric acid and subsequent washing in a funnel. This operation was repeated at least once.

All nitric-acid solutions that might contain mercury were collected and brought nearly to the neutral point with ammonium hydroxide. Hydrogen sulphide was then passed for some time, the precipitate collected on a filter, and the filtrate again treated with hydrogen-sulphide to make sure of complete precipitation. Any mercuric sulphide in the sample of fume obviously would

not be affected by the nitric-acid treatment, but as the solution was not filtered before precipitation with H_2S, this sulphide would be collected with the precipitated sulphide. The filter-paper bearing the mercuric-sulphide precipitate and the paper from the Hawley filter thus

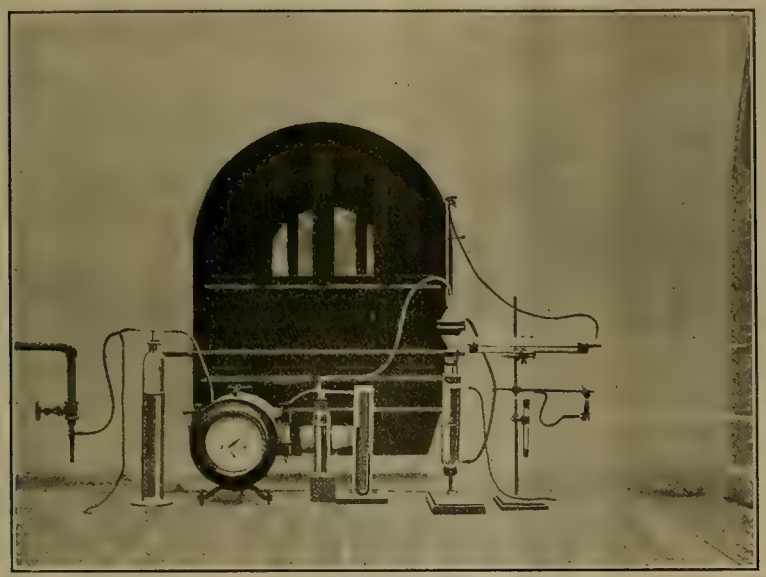

FIG. 2. APPARATUS FOR SAMPLING QUICKSILVER FUME

constituted the sample, which was analyzed by a method developed for the purpose.

DETERMINATION OF FLUE-GAS VOLUME. The low velocity of the flue-gases (less than two metres per second) made the use of a Pitot tube impossible. Attempts were made to determine the velocity by shooting a cloud of colored dust into the gas-stream, but, presumably due to the large amount of water-mist in suspension, the effect at the stack was too slight to be determined with certainty. The problem was successfully met by injecting ten to twelve litres of H_2S at the lower end of the flue and detecting its appearance at the end of a measured length of flue by chemical means. A large rubber bag, with a neck 2 cm. diameter, was placed between two boards, thus forming a sort of bellows, which permitted the injection of the entire volume of hydrogen sulphide within a fraction of a second. The arrangement for detecting the H_2S at the second station is shown in the lower right-hand corner of Fig. No. 3. A glass sampling-tube with several openings was placed well across the flue and a stream of gas was drawn by the aspirator from this through a small gas-washing tube containing 1 or 2 cc. of lead-acetate solution. A fairly concentrated lead-acetate solution, slightly acidulated with nitric or acetic acid, was found to be most sensitive. The timing was done with a stop-watch. It was assumed that the observed velocity was a maximum corresponding to that of the more rapidly moving central core of the gas-stream. The mean velocity was computed[4] by using the

[4]Loeb, F. Jour. Am. Soc. Naval Eng., November 1912, Vol. XXIV, p. 1115.

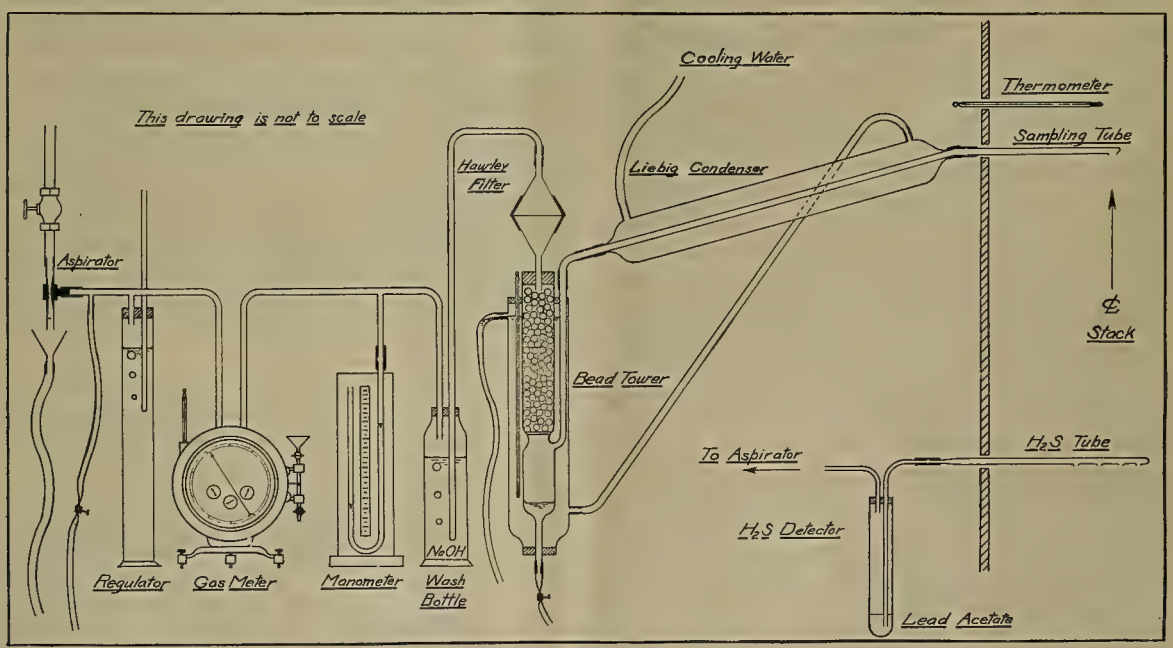

FIG. 3. APPARATUS FOR SAMPLING QUICKSILVER FUME

TABLE I.—SUMMARY OF STACK FUME-LOSS DETERMINATIONS

Date 1917	Av. temp. flue deg. C.	Barom. press. stack. mm. Hg	Fume sample: Vol. dry at 0°C., 760 mm., litres	Fume sample: Hg found, gm.	Velocity determinations: Time* noted, sec.	Mean velocity† metres per sec.	Mean velocity† Feet per sec.	Flue-gas volume: Discharge per min., stack, cond. cu. ft.	Flue-gas volume: Discharge per min., stack, cond. cu. m.	Discharge 24 hr., dry, 0°C., 760 mm., cu. m.	Hg per cu. m. dry gas, 0°C., 760 mm., gm.	Observed Hg loss in 24 hr. kg.	Observed Hg loss in 24 hr. lb.
No. 1 Furnace System—New Idria (Old)													
5/30	40.0	688.59	95.5	0.0031	...	...	...	....	...		0.0325	1.60	3.53
6/ 1	41.3	688.59	107.8	0.0031	...	...	...	....	...	49,500	0.0288	1.42	3.13
6/ 6	40.7	688.59	102.2	0.0039	...	...	...	....	...	Assumed	0.0382	1.88	4.14
6/17	39.3	692.78	86.5	0.0013	...	...	...	....	...		0.0150	0.74	1.62
6/18	38.5	691.90	161.0	0.0030	64.2	1.19	3.92	1,670	47.3	50,800	0.0186	0.95	2.09
6/19	39.9	687.58	167.8	0.0056	68.0	1.13	3.70	1,570	44.5	46,600	0.0334	1.55	3.42
6/20	38.9	686.30	157.2	0.0019	69.0	1.11	3.65	1,550	44.0	46,200	0.0121	0.56	1.22
6/21	37.3	686.82	174.6	0.0049	59.8	1.28	4.21	1,790	50.7	53,800	0.0281	1.50	3.31
6/23	39.5	689.10	482.0	0.0280	58.6	1.30	4.28	1,820	51.5	54,250	0.0581	3.14	6.90
6/25	39.0	688.34	427.0	0.0206	57.0	1.34	4.42	1,875	53.1	56,000	0.0482	2.69	5.93
Average	39.44									51,275	0.0312	1.60	3.53
Calculated Hg vapor not recovered in sampling at 15°C											0.0081	0.41	0.91
Total											0.0393	2.01	4.44
No. 1 and 2 Furnace Systems—Oceanic													
7/16	31.3	754.00	536.4	0.0280	20.0	1.09	3.60	1,530	43.4	52,800	0.0522	2.74	6.04
7/17	30.7	752.00	527.5	0.0173	20.0	1.09	3.60	1,530	43.4	53,000	0.0328	1.74	3.82
7/18	30.5	754.00	220.0	0.0084	19.4	1.12	3.69	1,575	43.6	55,000	0.0382	2.10	4.62
7/20	35.4	754.00	431.2	0.0289	20.0	1.09	3.60	1,530	43.4	51,600	0.0671	3.46	7.60
Average	31.9									53,100	0.0475	2.51	5.52
Calculated Hg vapor not recovered in sampling at 15°C											0.0081	0.43	0.94
Total											0.0556	2.94	6.46
No. 1 Furnace System—New Idria (New)													
12/ 9	38.1		72.8	0.0075	...	...	...	....	...	(65,000)	0.1030	6.70	14.70
12/10	39.0		95.5	0.0097	50.0	1.53	5.04	2,140	60.6	64,000	0.1015	6.50	14.30
12/10	39.0		59.6	0.0055	47.0	1.63	5.35	2,270	64.3	68,200	0.0924	6.30	13.85
12/11	37.7	Assumed	87.8	0.0056	43.0	1.78	5.85	2,480	70.3	75,000	0.0637	4.71	10.48
12/14	36.4	to be	94.1	0.0081	50.0	1.53	5.04	2,140	60.6	65,250	0.0860	5.62	12.36
12/15	36.7	690 mm.	114.4	0.0244	45.0	1.70	5.59	2,370	67.1	72,250	0.2135	15.40	33.80
12/16	36.5		87.8	0.0048	40.0	1.92	6.30	2,660	75.3	81,400	0.0547	4.45	9.76
12/17	38.5		87.0	0.0136	40.0	1.92	6.30	2,660	75.3	80,100	0.1563	12.50	27.50
Average	37.7									72,314	0.1088	7.77	17.09
Calculated Hg vapor not recovered in sampling at 10°C											0.0057	0.41	0.90
Total											0.1145	8.18	17.99

*Distance over which gas-travel was timed was 280 ft. at New Idria and 80 ft. at Oceanic.
†It was assumed that the mean velocity was 0.9 of the velocity observed.

factor 0.9. From the mean velocity so obtained, and the flue-diameter, which was three feet in each case, the volume of gas was computed.

As a check on this method, the volume of gas was calculated from the fuel-consumption and the CO_2 content of the stack-gases, which were carefully observed during a three-day period. This calculation led to a stack-gas volume of 75,800 cu. m. of dry gas at standard conditions per 24 hours. The average derived from three determinations of velocity during this period was 72,300 cu. m. In view of the difficulties involved in determining flue-gas volumes the agreement is considered satisfactory.

Calculation of Results. In calculating the stack-loss from the results of the fume-sampling, the volume of dry gas at standard conditions was used as a basis. The observed volume of the sample, as indicated by the meter, was corrected for the meter-temperature and for the partial pressure of the dry gas. This latter is equal to the observed barometric pressure decreased by the aqueous tension at the temperature of the meter, and by the reduced pressure under which the meter operated, as indicated by the manometer. A further correction in the sense of increasing the volume of the sample by about 4% was necessary owing to the CO_2 and SO_2 absorbed by the wash-bottle that preceded the meter. Similar corrections based on the mean flue temperature, the barometric pressure, and the tension of water-vapor, were applied to the flue-gas volume.

As the sampling procedure did not completely remove all mercury-vapor from the flue-gas a correction based on the vapor-tension of mercury at the mean temperature of the Liebig condenser and bead-tower must be added to the mercury recovered. The earlier values for the vapor-tension of mercury below 100° C., including those of Regnault,[5] which have been used generally in metallurgical calculations, are much too high.

Results. A summary of the determinations of fume-loss is given in Table I.

The losses shown are to be taken as minimum rather than maximum, since such analytical and other errors as were present would be negative. The variation in individual results may be charged only in part to experimental error since the furnace conditions were not constant, particularly at New Idria, where concentrate was fed at intervals.

Using values interpolated from the table of vapor-tensions, given at the close, the total stack-loss may be apportioned between the losses in vapor and in mist. A cubic metre of flue-gas under flue conditions is taken as the unit for the calculations given in Table II.

According to these calculations the gas leaving the old condenser system at New Idria is only half-saturated with mercury-vapor. This may seem surprising but it was due presumably to the large amount of air leaking

[5]Regnault. Mem. de L'Acad. de Sci. de France, Vol. 26, 1862, p. 339.

Table II

	New Idria		Oceanic
	Old	New	
Mean temperature, degrees C.	39·4	37.7	31·9
Observed loss per cubic metre dry gas at standard conditions	0.0393	0.1145	0.0556
Volume of gas at standard conditions corresponding to 1 cu. m. of stack-gas	0.734	0.742	0.846
Total loss per cubic metre stack-gas; grammes Hg	0.020	0.085	0.047
Vapor-loss; grammes Hg	(0.059)	0.052	0.034
Mist-loss by difference; grammes Hg	....	0.033	0.013
Percentages of mist	....	39	28

into the condenser system at various points, coupled with the slow rate of evaporation from the mercury particles covered with a protecting water-film. A similar unsaturated condition, as regards arsenic trioxide in the flue-gas from a copper-smelter, is noted in Technical Paper

(tierra) furnaces at New Almaden, which received 320.9 kg. of mercury in the form of 1.51% ore per 24 hours, the metal input was accounted for as follows:

	%
Direct yield	92.71
Loss in residue	0.66
Loss in vapor	1.73
Loss in mist (by difference)	4.90
Total	100.00

Taking his figure for the gas-volume leaving the stack at 20° C. as 24,306 cu. m. per 24 hours, the above loss is equivalent to a mercury-content of 0.658 gm. per cubic metre. Of this 0.232 gm. is charged to vapor-loss owing

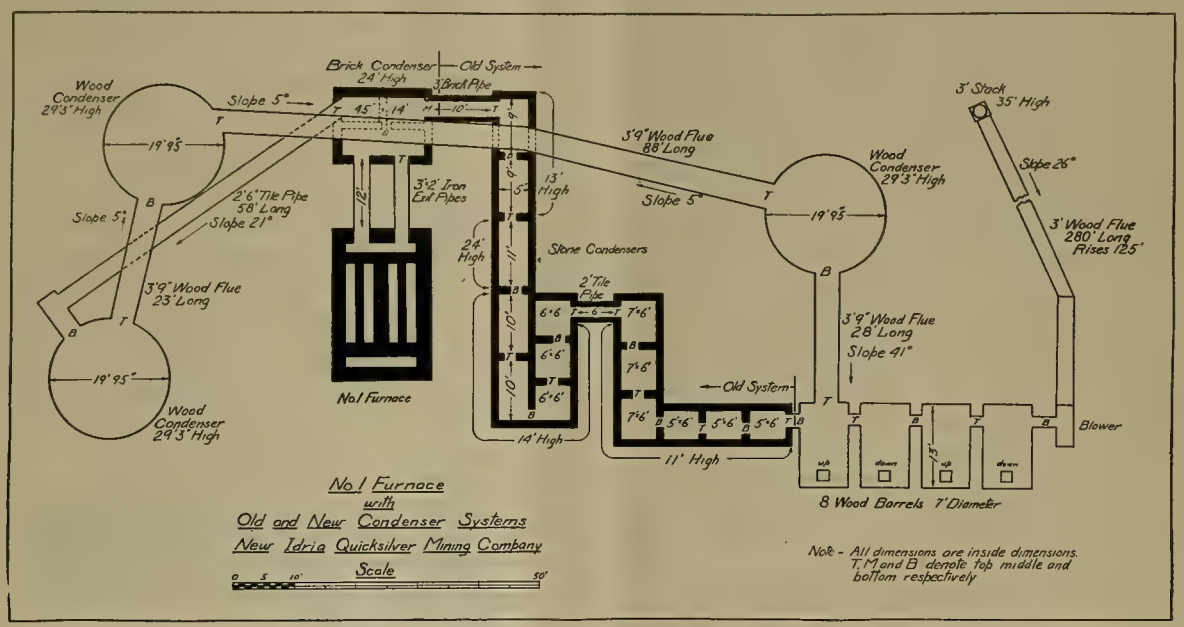

FIG. 4. PLAN OF OLD AND NEW CONDENSER SYSTEMS AT IDRIA, CALIFORNIA

No. 81 of the U. S. Bureau of Mines.[6] It is not certain that in the other cases the stack-gas was saturated with mercury-vapor, although sufficient metal was present for this purpose. That the mercurial particles leaving the stack are largely in the form of free metal is indicated by the following analysis of sludge from the base of the stack. After separating as much free mercury and water as possible by centrifuging, the air-dried residue had the following composition:

	%
Hg (metallic)	64.3
HgS	5.0
Mineral matter (non-volatile)	4.2
Moisture, acid and organic matter (by difference)	26.5
Total	100.00

COMPARISON WITH PREVIOUS RESULTS. From a careful study by Christy[7] of the operation of one of the fine-ore

to the use of what we now know to be an erroneous value for the vapor-tension of mercury at this temperature. The correct value for the vapor-loss, based on the vapor-pressure data given in the appendix, is 0.0132 gm. per cubic metre. No direct determinations of stack-loss were made by Christy, and as the values which he adopted were obtained by difference, it is likely that they include losses occurring in other ways. Inaccuracies in sampling and assaying would also affect his result.

Castek's[8] paper on losses at Idria, Austria, contains, on page 235, a tabulation of stack-loss determinations which indicate an average content of 0.00232 gm. mercury per cubic metre of stack-gas. With a gas-volume of approximately 177,000 cu. m. (stack conditions 15° C. and 724 mm.) per 24 hours, the daily loss was therefore 411 gm., which was about 0.03% of the daily production. It will be noted that the above figure for the mercury-content of the Idria stack-gas is much less than the values given in Table II. Apparently, however, their procedure in sam-

[6] Welch, H.V., and Duschak, L. H. 'The Vapor-Pressure of Arsenic Trioxide,' 1915, p. 20.

[7] Christy, S. B. 'Quicksilver Condensation at New Almaden, California,' Trans. A. I. M. E., Vol. 14, 1885, pp. 206-265.

[8] Castek, Franz. Berg- und Hüttenmännisches Jahrbuch der K. K. Montanistischen Hochschulen zu Leoben und Pribram, Vol. 58, 1910, pp. 1 and 235.

pling, which is only briefly described as a filtration of the stack gas through a plug of glass-wool or asbestos in a glass tube, was designed to stop only the mercury-mist. On page 239, Castek states that a number of attempts were made to detect a vapor-loss, but with uniformly negative results. Apparently the stack-gas was far from being saturated with mercury-vapor. Castek, however, adopts the same erroneous value as that used by Christy in calculating the vapor-loss, and he therefore arrives at a value about 25 times too large.

Although the stack-losses that we found are very small and represent, in the case of New Idria, less than 1%, and at the Oceanic less than 2% of the mercury input, it is instructive to consider whether the relative magnitude of these losses is related to the form of the condenser system used. Fig. 4 shows the old and the new condenser systems of No. 1 furnace at New Idria, and Fig. 5 the condenser system at Oceanic. The old system at New Idria consisted of the conventional brick and stone chambers, followed by wooden barrels and a side-hill flue and stack. In the new system only the first brick condenser was retained. From this, a tile-pipe led to the first of a series of three wooden tanks of about 9000 cu. ft. capacity each. A stream of cold air equal to about one-third of the gas-volume leaving the furnace was introduced into the tile-pipe just beyond the first brick-condenser, as shown in Fig. 6. The 10-in. pipe carrying the air terminated with a 45° bend so that the air-stream was injected parallel to the centre line of the tile-pipe. A water-spray was introduced with the air.

The condenser system at Oceanic consists largely of rectangular wooden chambers. Data pertaining to these condenser systems, which may have a bearing on fume-losses, are assembled in Table III.

system, the equivalent volume of the latter, which is composed of two partly separate systems, is about twice that of the former. The mean stack-temperature at Oceanic is also considerably lower, but in spite of these favorable factors, the daily loss of mercury is a little larger. The number of changes of velocity and direction of the gas-stream is, however, distinctly less at Oceanic.

So far, then, as it is permissible to draw a conclusion from the data presented, it would be that such baffling effect as occurs in the conventional brick or stone condenser system is considerably more effective in recovering quicksilver than a mere increase in condenser volume.

It is obvious, of course, that the gas-volume should be as small as possible. For a given condenser system, other things remaining constant, an increase in the gas-volume will produce more than a proportionate increase in the mist-loss alone, because the higher velocity of the gas-stream will considerably increase its carrying power. Richards[9] states that the carrying power of the gas-stream is probably proportional to the cube of its velocity. The vapor loss, assuming a saturated stack-gas, would be proportional to the volume. As regards vapor-loss, a reduction of the temperature of the stack-gas as it leaves the new system at New Idria to 20°C. would convert nearly three-fourths of the escaping mercury, equivalent to 3.6 kg. per 24 hours, into mist that could be recovered if it were considered worth while to do so. A similar reduction in temperature at Oceanic would convert, roughly, three-fifths of the vapor, equivalent to 1.2 kg. per 24 hours, into mist. The particles of mercury in suspension, as has been suggested above, can be partly removed from the stream of gas by suitable baffling. An elaborate series of experiments upon the separation of suspended particles from the gas-stream

TABLE III.—CONDENSER SYSTEM DATA

	New Idria No. 1, old	New Idria No. 1, new	Oceanic No. 1	Oceanic No. 2
Interior volume, cubic metres	489.0	1,098.5	723.9	1,090.9
Interior area, square metres	1,331.8	1,651.5	1,555.2	1,505.0
Materials of construction; per cent volume enclosed by:				
Iron and tile	1.00	1.20	0.80	0.60
Brick and stone	63.00	8.20	27.00	16.00
Wood	36.00	90.60	72.20	83.40
Path of gas, metres	261.0	253.0	165.0	166.0
Changes in direction of gas-stream	52	26	25	12
Changes of velocity of gas-stream	48	24	30	10
Gas volume, cubic metres at stack conditions:				
Per 24 hours	69,800	97,430	62,800	
*Per ton of ore	1,160 (60)	1,400 (70)	700 (90)	
*Per kilogramme Hg	116 (600)	118 (825)	370 (170)	
Mean flue velocity, metres per second	1.37	1.91	1.23	
Mean stack temperature, degrees C	39.4	37.7	31.9	
Grammes Hg per cubic metre stack conditions	0.029	0.085	0.047	
Loss Hg per 24 hours, kilogramme	2.01	8.18	2.94	

*Note: The figures in parentheses indicate approximate daily tonnage and daily quicksilver production in kilogrammes.

Considering first the old and the new systems at New Idria, the daily loss from the new system was roughly four times that from the old one, although the volume of the new condenser system is more than double that of the old. On the other hand, the factors favoring a larger loss from the new system were a gas-volume 50% greater with a consequent higher mean velocity throughout the condenser system, and a fewer number of changes of velocity and direction in the gas-stream. The final stack-temperature was essentially the same in both cases. Comparing the old system at New Idria with the Oceanic

by different methods of baffling was conducted at the Great Falls plant of the Anaconda Copper Mining Co. several years ago.[10] Taking into consideration the amount of dust collected, the interference with draft, and other important factors, including the cost of construction, it was concluded that baffles consisting of wires

[9]Richards, Joseph W. 'Metallurgical Calculations,' Part III, 1908, pp. 630-631.

[10]Goodale, C. W., and Klepinger, J. H. 'The Great Falls Flue System and Chimney.' Trans. A. I. M. E., Vol XLVI, 1913, p. 583.

hung vertically a few inches apart were the most effective. In a quicksilver condenser, vertical strips of wood might be used instead of wires.

Without doubt the most effective way of recovering all the mercury in suspension would be through the use of electric precipitation. This method has been employed by the New Almaden Quicksilver Mining Co. in connection with the Herreshoff furnace, both for the removal of dust from the hot gases and for the recovery of mercury-mist from the final stack-gases. The advisability of installing a system for recovering the mercury-mist from the stack gases is a question of practical economics, requiring separate consideration for individual plants.

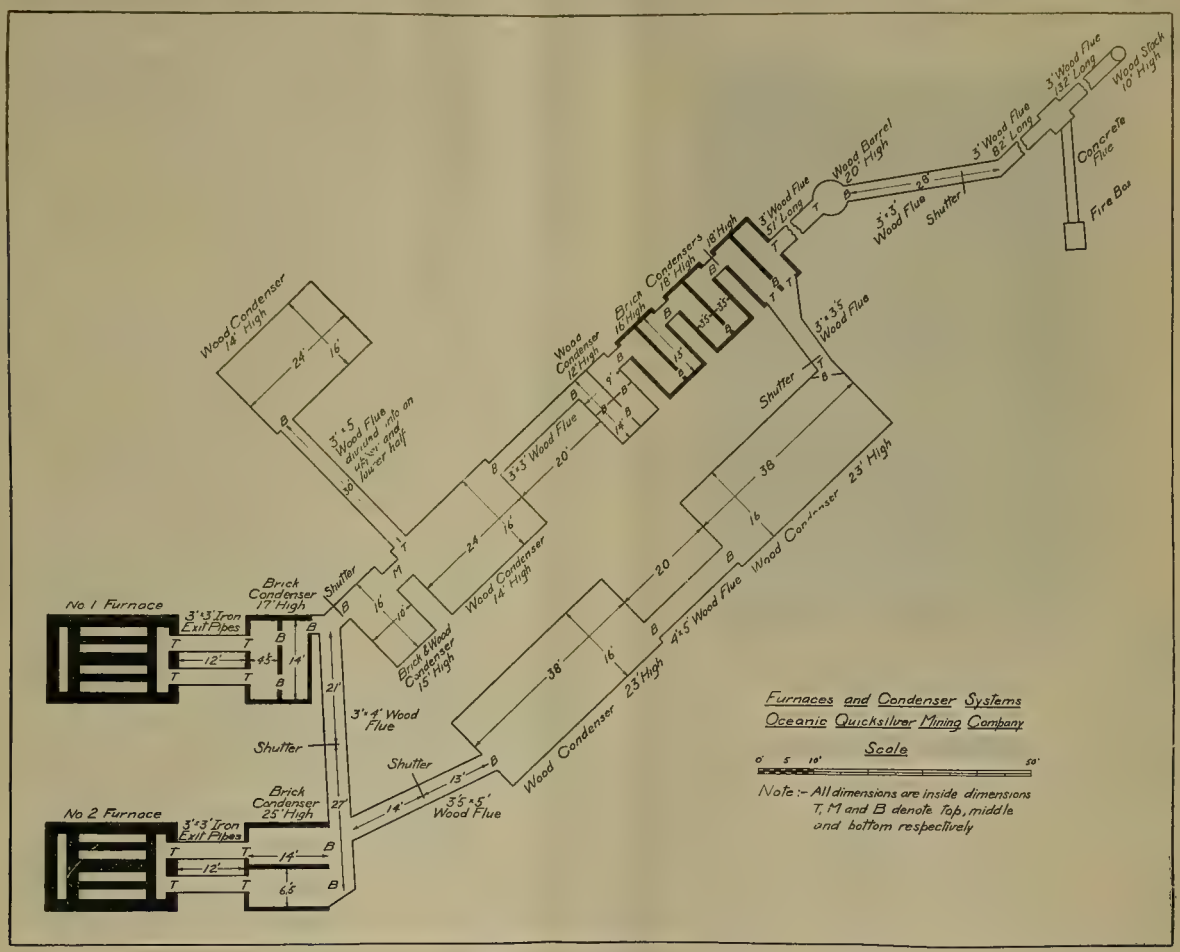

FIG. 5. PLAN SHOWING CONDENSER SYSTEM AT THE OCEANIC MINE, CALIFORNIA

Losses in Water. Water escaping from a condenser system may carry mercury either in the form of minute metallic particles, commonly called 'flowered' mercury, or in the form of mercury salts in solution. Castek concluded that at Idria the loss of mercury in the water leaving the first portion of the condenser system, which was constructed of vitrified stoneware pipes, amounted to about 0.1% of the input, or, roughly, 17 kg. per day. The question of water-losses was taken up coincidently with the stack-loss determinations. With the old condenser system at New Idria (Fig. 4) it was impossible to measure or to sample accurately the water leaving the condenser system, as an unknown amount escaped through the bottom of the brick and stone condensers into the earth. A sample of water, taken shortly after a clean-up and carrying more than the normal amount of mercury, was found to contain 0.15 gm. of mercury per litre. In the absence of a direct determination, the maximum amount of water that might escape from the condenser system was calculated by deducting from the total amount leaving the furnace the portion escaping from the stack as mist and water-vapor. The water content of the stack-gases was calculated from some rough observations taken in the course of sampling the fume. On this basis the waste-water was found to be something less than 2000 litres per day. Taking this as an average, the corresponding loss of mercury is 0.3 kg. per day or 0.05% of the output from the furnace.

In operating the new condenser system, water was sprayed into the gas-stream and also applied to the outside of the wooden tanks and pipe-connections at a number of points. This cooling water, together with that

condensed from the furnace-gases, escaped from the system at two points: that from the first and second wooden condensers (Fig. 4) flowed through a series of launders to a single wooden settling-box and thence to waste; the water from the remainder of the system passed through a long series of launders and then through several settling-boxes.

A number of measurements was made of the volume of water leaving each section of the condenser system under varying conditions, and average samples were taken from each water-stream at the point where it finally ran

FIG. 6. ARRANGEMENT FOR INTRODUCING COLD AIR INTO TILE-PIPE OF THE CONDENSING SYSTEM AT IDRIA

to waste. The results of these observations are given in Table IV. The so-called normal loss was thus 2.19 kg.

Table IV—Water Loss Data, New Condenser System, New Idria

	Conditions	1st sec., tanks 1 and 2	2nd sec., tanks 3 onward
Mercury in solution, gm. per litre.	normal	0.0404	trace
Mercury in suspension, gm. per litre.	normal	0.0412	0.0056
Mercury in solution, gm. per litre.	just after run-down	0.0088	.....
Mercury in suspension, gm. per litre.	just after run-down	0.1395	.....
Volume of water per 24 hr., litres..	normal	26,300	8,770
Volume of water per 24 hr., litres..	maximum	40,900	29,650
Mercury lost per 24 hr., kg.....	normal	2.14	0.049

mercury per 24 hours. To this must be added about 0.5 kg., representing the additional loss occasioned by the agitation during the daily run-down. This leads to a total loss of 2.69 kg. per day. The corresponding loss for the maximum volume of water observed would be about one and one-half times this.

At the Oceanic plant all condenser-water was led to a single settling-tank. A sample of the overflow water from this tank was found to contain 0.018 gm. mercury per litre. With an estimated daily flow of 1500 litres, the loss of mercury would be 0.027 kg. The relatively large loss in the case of the new system at New Idria may be attributed primarily to the increased quantity of water, which was about twenty times that used in either of the other cases. It will be noted that under normal conditions about 50% of this loss was due to metal in suspension, and that during the period of the run-down, the escaping mercury was largely in this form. No doubt a considerable portion of this suspended metal could be recovered by a suitable system of settling-tanks.

The mercury in solution was probably present in the form of sulphate, formed by the action of sulphuric acid on the metal. Mercury can be completely precipitated from solution by scrap-iron, but if the condenser water contains much acid the consumption of iron might be out of proportion to the mercury recovered. At New Idria it so happened that the water supplied to the condensers contains sufficient alkali to neutralize the acid from the

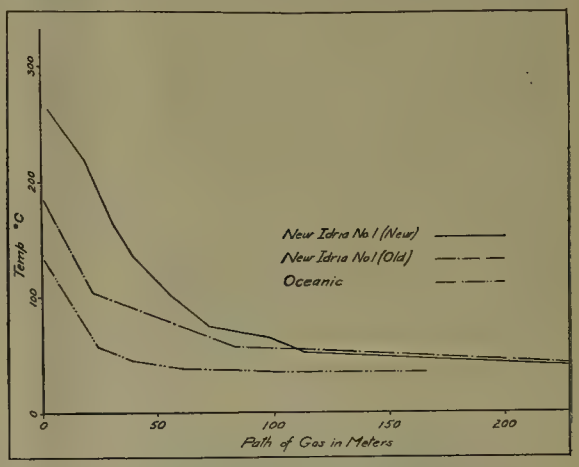

FIG. 7

furnace so that in some cases the water leaving the condenser system was actually alkaline. Under these conditions the wastage of iron should be small.

OTHER CAUSES OF LOSS. Although not susceptible of measurement, certain other ways in which mercury may be lost from the condenser system should be mentioned. It is the usual practice in this country, as well as in Europe, to avoid the danger of losing mercury through gas-leakage by operating the condenser system under a slightly reduced draft. There can be little question as to the wisdom of this procedure, as a slight escape of mercury-laden gas will result in a vastly greater loss than that occasioned by the inward leakage of a like amount of air. For example, the daily leakage of 2500 cu. m. of saturated gas, at 100°C. would result in a vapor-loss of 8.1 kg. and the actual loss would probably be somewhat greater owing to particles of mercury in suspension. This volume is less than 5% of the gas-flow observed at the Oceanic plant. In view of the fact that the inward leakage of air to the extent of 20 to 50% of the gas-stream has been observed at several plants, it is evident that a large loss would result if an equal outward leakage were to occur. The danger of serious loss is greatest close to the furnace where the temperature is high and the mercury content of the gases large. It should be noted that the pressure at the top of any condensing-chamber will be greater than at the bottom, and

that for the taller portions of the condenser system, and particularly for those near the furnace, there may be a considerable difference in pressure. An in-draft at the bottom does not necessarily mean that there is an in-draft at the top. Moreover, owing to the more vigorous air-currents near the top of the condenser system, leaks in this region may not reveal themselves so prominently. All parts of a condenser system should be readily accessible for inspection, and inclined draft-gauges, such as the Ellison gauge, may be used to advantage at danger-points to indicate whether a safe condition of in-draft is being maintained.

Absorption losses include those arising from the penetration of the condenser material by mercury. As was pointed out by Castek and others, this loss is most noticeable with a new condenser system, and the mercury retained by the condenser material is supposed to be eventually recovered. There are, however, certain ways in which losses of mercury can occur through the use of pervious material in the construction of the condenser; these do not appear to have been recognized. We have observed that when, in the course of the periodic 'clean-ups' the interior of the brick condensing-chambers close to the furnace was washed down with water a shower of mercury was apt to fall from the outer surface. This was presumably caused by the expulsion of mercury contained in the pores of the brickwork by steam arising from the water, which penetrated the hot condenser-wall. The same action may take place automatically at certain points owing to fluctuations in the temperature and the moisture-content of the furnace-gases. The phenomenon mentioned supports the common belief that the brickwork of an old condenser system is pretty well saturated with mercury. When this condition exists a considerable surface of mercury may be exposed on the exterior of the condenser system, and where the temperature is high it is not unlikely that considerable evaporation of mercury ensues. The possibility of this is indicated by calculations made from data presented by Knudsen.[11] The amount of mercury that should theoretically evaporate in 24 hours from one square metre of the metallic surface in a vacuum is, roughly, as follows:

Degrees. C.	Kg.
100	10,000
50	480
30	110

This enormous rate of evaporation has been nearly realized in actual experiments in vacuo, but in the presence of other gases the rate would be much less. Assuming that mercury exposed to air will evaporate at only one-thousandth of the above rate, the amount of metal that may be lost in 24 hours per square metre of surface exposed is still considerable. Moreover, the appearance of some of the condenser systems now in use suggests that the surface of mercury exposed in the aggregate may be considerable. These considerations emphasize the desirability of building condensers of material impervious to mercury-vapor.

[11]Knudsen, M. Ann. der Physik. Vol. 47, 1915 (4), p. 697.

Mechanical losses may occur through leaks in the bottom of a condenser system and through spattering during the 'clean-up'. The older practice of building condensers on the ground, or close to it, makes proper inspection impossible, and the considerable quantities of mercury which have been recovered recently from the ground below the foundations of condensers at two plants in California bears eloquent testimony to the necessity for protection against this cause of loss. The practice now favored is to support condensers well above the ground, with properly inclined concrete floors below, thereby diminishing the danger of mechanical loss.

Conclusion. It has been found that the condenser losses that can be measured accurately represent at most but a small proportion of the output of a plant. It should not be concluded from this, however, that the total efficiency of condensing systems now in use is of the order of 95%. The losses mentioned in the last portion of this report undoubtedly have been large at times. The point of fundamental importance established by this investigation is that there are no inherent difficulties to prevent the recovery of at least 96 to 99% of the mercury-vapor entering the condenser system.[12]

The following are average values for the vapor-pressure of mercury after a critical study of several recent investigations.[13]

These are all lower than the old accepted values, the difference being most marked at the lower temperatures.

Vapor-Pressures of Mercury

Temp., deg. C.	Vapor pressure mm. mercury	—Mercury vapor per cu. m.— I—kg.	II—kg.
0	0.000184	0.00000216	0.00000216
10	0.000484	0.00000549	0.00000569
20	0.00121	0.0000132	0.0000142
30	0.00277	0.0000293	0.0000325
40	0.00599	0.0000614	0.0000704
50	0.0127	0.000126	0.000149
60	0.0254	0.000245	0.000298
70	0.0486	0.000454	0.000584
80	0.0896	0.000814	0.00105
90	0.1597	0.00141	0.00188
100	0.2756	0.00237	0.00324
110	0.4635	0.00388	0.00545
120	0.7529	0.00614	0.00885
130	1.198	0.00953	0.0141
140	1.860	0.0144	0.0219
150	2.829	0.0214	0.0334
160	4.217	0.0312	0.0498
170	6.171	0.0447	0.0731
180	8.872	0.0628	0.105
190	12.55	0.0869	0.150
200	17.47	0.118	0.210

In the column marked I the figures express the weight of mercury per cubic metre of saturated vapor, measured at the given temperature, and in column II they indicate the weight of mercury required to saturate one cubic metre of gas (air) measured at 0°C. and raised to the given temperature under constant pressure. These values are particularly useful in calculations such as those involved in this paper.

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[12]Valuable assistance in these investigations was afforded by G. N. Libby and Vance P. Edwardes in the fieldwork, and by W. C. Riddell and C. M. Bouton in the analyses.

[13]Smith, Alex. and Menzies, A. W. C. Jour. Am. Chem. Soc., Vol. 32 (4), 1910, pp. 1434-1447.

Knudsen, M. Ann. der Physik, Vol. 29 (4), 1909, pp. 179-193, and Vol. 32 (4), 1910, pp. 809-842.

Laby, T. H. Phil. Mag., Vol. 16 (6), 1908, pp. 789-796.

Haber, F., and Kerschbaum, F. Zeitschr. für Elektrochemie, Vol. 20, 1914, pp. 296-305. (20°C. only.)

Magnesite at Mid-Year, 1918

Steel-makers use large quantities of magnesite brick and granular magnesite to line their furnaces. Magnesite is used also as cement for sanitary floors, as stucco or plaster for exterior and interior walls, and as a non-conductor of heat in pipe and furnace coverings. In these days of large production of steel it is fortunate that we have an abundance of magnesite and are not dependent on a European supply.

According to R. W. Stone, of the U. S. Geological Survey, the production of magnesite in the six months ended June 30, 1918, was 93,700 short tons, of which California produced more than half. According to the best figures available, the Californian output was 47,600 tons of crude magnesite and Washington 46,100 tons. Only two companies were producing in Washington, and one of these stopped quarrying from February to May in order to enlarge its calcining-plant and develop the deposit. The rate of production in California is 50% less than in 1917, and the rate in Washington is 88% of that of last year. The output of California in the second half of 1918 will probably be no larger than in the first half, but that of Washington may be much larger, for development has now reached a stage where rock can be quarried, calcined, and shipped at an increased rate. The production for the entire year may be 225,000 tons, against 316,000 tons in 1917.

The increased freight-rate and the importation of magnesite from Canada have greatly reduced the demand for the Californian ore for use as a refractory material, so that all the small and some of the large producers have stopped work, and the others are operating with reduced force.

Some manufacturers of refractory products in the Eastern States, who used large quantities of Californian and Washington magnesite in 1917 are now using a considerable quantity of Canadian ore instead of the more expensive domestic material. The Canadian magnesite, which comes from Grenville, Quebec, is crystalline, but carries a high proportion of lime. Extensive masses of Canadian magnesite average from 7 to 10% of lime. It can be delivered by boat to Buffalo, Cleveland, and Chicago, at much lower cost than magnesite can be brought from California and Washington, and is being substituted for the higher-grade domestic material. In 1917 we imported 2148 tons of Canadian calcined magnesite, and in the first five months of 1918, 5809 tons. Imports of calcined magnesite from Canada in April 1918 were more than the total imports from Canada in 1917, and the imports in May nearly equaled those of the previous year.

In the summer of 1917 Mr. Stone visited the magnesite field in Washington and many of the fields in California, collecting samples for analyses. Of the 29 samples analyzed, 24 were crude magnesite and 5 were calcined. The results of the analyses made in the laboratory of the Survey are given in the following table (Chase Palmer made the analyses):

	1	2	3	4	5	6	7	8	9	10	11	12	13[a]	14	15
SiO_2	1.94	2.43	2.26	4.35	12.65	13.88	2.57	14.72	8.73	9.57	1.82	0.50	0.50	2.70	1.67
FeO	1.49	2.40	2.11	1.71	.80	1.49	.89	1.35	.97	1.00	.50	.20	[b].43	.23	.31
CaO	.67	1.57	1.52	2.11	.95	.27	.80	.64	.39	2.83	1.85	1.02	4.90	.80	1.17
MgO	45.01	43.62	44.10	42.62	40.73	39.60	45.65	39.60	43.18	42.48	45.12	45.90	83.17	46.02	45.75
CO_2	50.65	50.11	50.18	49.05	44.64	44.62	50.33	43.73	46.31	44.70	50.73	51.68	11.34	50.32	50.95
	99.76	100.13	100.17	99.84	99.77	99.86	100.24	100.04	99.58	100.58	100.02	100.20	100.34	100.07	99.85

	16[a]	17	18	19	20	21	22[a]	23	24[a]	25[b]	26[a]	27	28	29
SiO_2	0.51	12.05	2.40	0.65	6.37	1.10	5.21	1.85	5.56	5.33	1.20	4.27	4.83	5.60
FeO	[c]1.57	2.83	1.44	.33	.35	.72	[c]1.70	.88	[c]1.74	1.01	[c]2.36	.78	.85	.88
CaO	2.48	1.98	3.68	2.65	2.88	1.17	2.18	1.74	2.31	.35	.92	1.07	7.39	6.88
MgO	90.30	38.88	42.56	45.43	41.55	45.64	89.08	45.20	74.39	43.52	90.59	45.02	38.41	40.90
CO_2	5.22	44.84	49.94	51.42	49.18	51.20	1.65	49.70	15.95	47.91	5.23	49.51	47.81	46.03
	99.08	100.58	100.02	100.48	100.33	99.83	99.82	99.37	99.95	98.12	100.30	100.65	99.29	100.29

[a] Calcined.
[b] This sample contains also 1.81 per cent of material insoluble in acid.
[c] Fe_2O_3.

1. White Rock mine, bunker, Pope valley, Napa county, California.
2. White Rock mine, east vein, stock-pile, Pope valley, Napa county, California.
3. White Rock mine, upper tunnel, Pope valley, Napa county, California.
4. Tulare Mining Co., Blanco mine, stock-pile, Chiles valley, Napa county, California.
5. Soda Creek mine, Detert & Elder, south tunnel, stock-pile, Soda valley, Napa county, California.
6. Soda Creek mine, north tunnel, stock-pile.
7. Harker quarry, stock-pile, Gilliam creek, Sonoma county, California.
8. Sonoma Magnesite Co. lower mine, stock-pile, Austin creek, Sonoma county, California.
9. Sonoma Magnesite Co. upper mine, stock-pile.
10. Cedar Mountain mine, Clark & McDonald, sacked for shipping, Alameda county, California.
11. Western Magnesite Development Co., White Queen mine, 250 ft. inside tunnel, Red mountain, Santa Clara county, California.
12. White Queen mine, stock-pile.
13. White Queen mine, kilns.
14. Pacific mine, bunker, Red mountain, Santa Clara county, California.
15. Red Mountain Magnesite Co., Butcher mine, bunker, Red mountain, Stanislaus county, California.
16. Butcher mine, cooling-bins.
17. McLaughlin mine, stock-pile on loading-platform, Bradford ranch, Evergreen, Santa Clara county, California.
18. Jackson mine, stock-pile, Cochrane ranch, Morgan Hill, Santa Clara county, California.
19. Warwick mine, lower cut, stock-pile, Madrone, Santa Clara county, California.
20. Warwick mine, upper cut, stock-pile.
21. Hoff-Price Co. mine, stock-pile, Sampson peak, San Benito county, California.
22. Hoff-Price Co. mine, cooling-floor.
23. Northwest Magnesite Co., Finch quarry, five freight-cars, Chewelah, Stevens county, Washington.
24. Northwest Magnesite Co., cooling-floor at kilns.
25. American Mineral Production Co., bunker at Allen quarry, Valley, Stevens county, Washington.
26. American Mineral Production Co., cooling-floor at kilns.
27. American Mineral Production Co., Red Marble quarry, stock-pile.
28. U. S. Magnesite Co., upper 40 ft. of quarry, 18 miles west of Springdale, Stevens county, Washington.
29. U. S. Magnesite Co., 18 ft. in middle of quarry.

This is the largest number of official analyses of Californian and Washington magnesite that has yet been published. Of all the Californian magnesite here shown, that of the White Rock mine, Napa county, is highest in iron content and at the same time reasonably low in silica and lime. Material from two small properties (No. 17 and 18) in Santa Clara county carries as much iron, but one is high in silica and the other is high in lime. The White Rock mine is supplying much of the calcined magnesite used by steel-mills on the Pacific Coast. Some of the Californian magnesite that is high in silica is used for plastic purposes and is said to be satisfactory.

Washington magnesite is crystalline, like marble or dolomite, and unlike the non-crystalline Californian product. Many analyses of Washington magnesite made by reputable chemists have shown 1 to 3% of calcium oxide, 1 to 2% of iron oxide, and silica commonly between 2 and 6%. It should not be concluded from the analyses herewith that the magnesite from the Finch quarry (23) is commonly so low in silica or that from the Allen quarry (25) commonly so high as shown. The magnesite represented by analyses 28 and 29 was considered inferior and production at the U. S. Magnesite Co. quarry discontinued after a few weeks.

Flotation at Mount Morgan, Australia

During the year ended June 2, 1918, the Mount Morgan mine in Queensland produced 17,064,360 lb. of refined copper and gold valued at $1,782,150, from 362,507 tons of ore and 32,945 tons of metal-bearing flux. The concentrator dressed 214,989 tons of the total, recovering 83,567 tons of concentrate. During the second half of the period the following results were recorded:

		Assays		Recovery	
	Tons	Copper, %	Gold, value	Copper, %	Gold, %
Ore concentrated	123,854	2.29	$5.10	....	....
Jigged concentrate	20,508	2.60	$4.10	18.83	13.31
Table concentrate	25,071	3.70	$8.51	32.72	33.79
Flotation concentrate	6,295	18.66	$29.18	41.46	29.09
Total concentrate and average	51,874	5.08	$9.28	93.01	76.19

Mechanical troubles reduced the recovery of copper, when compared with the previous period. Additional grinding machinery is to be put in, tests are being made with the cascade and sub-aeration flotation systems, the settling-area has been extended, and slime is to be retreated. These improvements are expected to increase the recovery considerably.

CALCIUM CHLORIDE is used as the circulating fluid in refrigerating plants, in automobile gas-engine water-jackets to prevent freezing, and, on account of its power of absorbing moisture, for laying dust on roads and drill-grounds, drying gases, vegetables, and fruits, and dehydrating organic liquids. In solution it is especially valuable in automatic sprinkler-systems and in fire-buckets. It is made as follows: After salt, and in some places bromine, has been extracted from brine, the remaining bittern is heated, agitated with milk of lime, and the suspended matter is allowed to settle. The clear liquid is evaporated, and after part separation of the salt the bittern is run to another evaporator and concentrated further. From this pan it goes to a settling-tank where the rest of the salt settles out. The bittern is then boiled in a cauldron and run into metal drums, where it solidifies. It is placed on the market in this form.

Pulverized Coal

*The cost of coal pulverization depends upon the amount of moisture that must be removed before pulverization, upon the cost of labor, and on the cost of coal delivered at the plant. The advantages to be derived from the use of pulverized coal are conservation of coal, reduction of labor by substitution of mechanical devices for manual processes, and an increase in efficiency, since any carbonaceous fuel, from lignite to graphite, can be burned more efficiently in this manner. Coal can be injected into a furnace on a column of low-velocity air without detrimental erosion of the refractory lining. Constant temperatures can be maintained in the furnace, and gas carrying as much as 17% CO_2 can be obtained. For kilns, boilers, and metallurgical furnaces coal containing about 35% volatile matter, 50% carbon, 8% or less of ash, and 2% or less of moisture, are preferable, but with 25% ash and 5% sulphur they cause trouble. The coal should contain 1% or less of moisture, but lignite can be readily handled with 5 to 8% of combined moisture. It should be ground so that 95% will pass a 100-mesh screen and 70% a 300-mesh sieve. On a basis of 200 tons of coal per day, containing 7.5% moisture, and at the present prices of wages, supplies, and coal, the cost of pulverizing will be between 30 and 40c. per ton, not including overhead charges, interest, and depreciation. In transporting pulverized coal, dust must be avoided in order to minimize the risk of explosion. The use of air currents for transportation is bad practice. The feeders must absolutely control the flow of the fuel to the burners, which may be of the inductive or positive type. Lignite and bituminous coal require no special furnace, but fuels low in volatile matter and high in fixed carbon, such as anthracite and coke-breeze, require a furnace in which the incoming fuel and the air pass through the flame, and the products of combustion in a water-cooled, arched, fire-brick chamber on their way to the furnace or boiler. The ash from anthracite, lignite, and coke-breeze does not slag, but the ash of bituminous coal may do so. The ash on the furnace floor should be removed from time to time. Temperatures from 1800° to 3500°F. can be maintained in the flame; slag forms most readily at the higher temperatures. With hand-firing, losses of 20 to 40% of the heat-value of the coal are frequent; producer-gas firing gives a loss of about 30 to 35% of the energy of the fuel; but with powdered coal practically no heat-loss occurs. Savings have been accomplished in the operation of copper-reverberatory furnaces amounting to 30 to 45%.

*Abstract: H. R. Collins, Trans. A. I. M. E., 1918.

Mobilization of Engineers

The U. S. Employment Office, which is a bureau of the Department of Labor, has issued a blank form for registration of technical men of all classes. This was prepared by A. H. Krom, director of the bureau, and is compactly arranged for giving a brief but complete statement of the applicant's experience. In view of the forthcoming registration of all men up to 45 years of age under the pending Man-Power Bill, this blank will be of special interest and value, and it is accordingly reproduced for the benefit of engineers who will be affected by the new legislation. While the country needs fighting men at the front, it also requires a strong efficient force of skilled engineers in the industrial plants that provide the materials essential to military operations, and by the use of this form it will be possible to show succinctly the particular qualifications of such trained men, so that they may be employed where they may render the most useful service. Every engineer should fill out one of these blanks at once and send it to the Director of Engineering, 29 South La Salle street, Chicago, or deliver it to the nearest local U. S. Employment Service office. This will facilitate the mobilization of the Nation's engineering talent.

GOVERNMENT CLASSIFICATION BLANK FOR ENGINEERS.

EXPERIENCE									ENGINEERING						SALARY	
Place number of years' practice in proper spaces below.									Indicate by X your special classification						Give figures on monthly basis	
Consulting	Commercial	Designing, Detailing and Checking	Contracting	Construction—Supt or Foreman	Inspection, Testing and Analyzing	Operation, Valuation & Scientific Management	Surveying—Instrument Man	Drafting—Tracing	CIVIL	MECHANICAL	ELECTRICAL	MINING	CHEMICAL	Architects, Salesmen and Teachers, give specials below	Salary Desired	Lowest Considered

CHECK YOUR EXPERIENCE ON SUB-CLASSIFICATIONS

I CIVIL ENGINEERING
1—Bridges
2—Buildings
3—Reinforced Concrete
4—Highways
5—Railways
6—Harbor Work
7—Dams and Reservoirs
8—Reclamation
9—Waterways
10—Municipal
11—Water Supply
12—Sanitation
13—Ship Building
14—Structural Steel

II MECHANICAL ENGINEERING
1—Ordnance
2—Bridge Machinery
3—Dredging Machinery
4—Hoisting & Conv. Mchy
5—Machine Shop Mchy
6—Refrigerating Mchy
7—Steel Mill Machinery
8—Textile Machinery
9—Light Automatic Mchy
10—Marine Engines
11—Automotive
12—Internal Comb. Engines
13—Aeronautics
14—Gas Mfng Equipment
15—Steam Plant Equipment
16—Heat., Vent. & Bldg. Eqpt.
17—Industrial Plants
18—Railway Rolling Stock
19—Tools

III ELECTRICAL ENGINEERING
1—Batteries, Ignition
2—Electric Railways
3—Industrial Elec. Appl.
4—Switchboards
5—Light and Power Plants
6—Control Equipment
7—Motors and Generators
8—Transformers
9—Overhead Construction
10—Radio and Wireless
11—Railway Signaling
12—Telephone
13—Telegraph
14—Testing Apparatus

IV MINING ENGINEERING
1—Assayer
2—Drilling Machinery
3—Metallurgist
4—Mill and Ore Dress Mchy
5—Mineralogist and Geolo.
6—Mine Survey
7—Mining Machinery
8—Coal
9—Open Pit
10—Ore Dressing Mills
11—Petroleum
12—Smelter and Equipment
13—Underground Mining

V CHEMICAL ENGINEERING
1—Chemical Plant Equipt.
2—Cement
3—Due Stuff
4—Explosives
5—Fertilizer
6—Gas
7—Oils
8—Glass
9—Soap
10—Hide and Leather
11—Iron and Steel
12—Paint
13—Photographic Supplies
14—Water Purification
15—Sewerage Treatment
16—Wood By-Products and Preservatives

Specials_____

I $\begin{matrix}\text{am}\\\text{am not}\end{matrix}$ engaged in war work and $\begin{matrix}\text{will}\\\text{will not}\end{matrix}$ leave present location.

My age is_____and my draft classification is_____

Print name_____

Print address_____

PLEASE FILL OUT AND MAIL AT ONCE TO DIRECTOR OF ENGINEERING

OATMAN, ARIZONA

Seventeen Months Operation of the United Eastern.

The United Eastern Mining Company has just issued its report for the year ended December 31, 1917, also for five months of 1918. It contains the following information:

J. A. Burgess is general superintendent, with W. O. North assistant; Wallace Keith, purchasing agent; J. W. Bradley, chief clerk; B. D. Boalen, mine foreman, E. M. Bagley, mill foreman; L. E. Ward, master mechanic; B. C. Staiger, mining engineer; and R. G. Davies, geologist.

The gross income last year was $1,830,360. Of this, $633,429 was profit. Six monthly dividends absorbed $408,900. Regular distributions of 5c. per share are now being made. The surplus was $224,529. Current assets totaled $436,546, and liabilities $208,108.

Including 298 ft. of sinking to a depth of 1164 ft., development amounted to 2364 ft. Substantial additions were made to ore-reserves above the 665-ft. level. Further sinking is to be undertaken. Reserves at the end of 1917 were 255,688 tons, valued at $5,830,971. At the Big Jim mine, acquired in April, 854 ft. of work gave favorable results; but exploration has been suspended on account of high costs.

The 200-ton mill was altered somewhat, increasing its capacity to 270 tons. Although fine grinding is necessary—80% through 200-mesh—the ore is readily amenable to cyanidation. There are no interfering minerals. The average extraction last year was 96.33%. The plant treated 84,548 tons of ore averaging $22.42 per ton, extracting 86,629 oz. of gold and 44,353 oz. of silver.

Costs per ton were as under:

Mining	$4.181
Treatment	2.159
Marketing	0.123
Indirect	0.650
Total	$7.113

Additions to plant and buildings cost $46,663.

Mr. Burgess' report under date of July 17, 1918, shows that for the first five months of this year, 39,410 tons of $21.88 ore had been treated. This yielded $548,329 net. Costs totaled $7.23 per ton, but cannot be expected to remain at this figure, on account of increased power and labor charges. No. 2 shaft was sunk to 1177 ft. Driving 500 ft. south on No. 8 level showed the vein not as strong or of as good grade as was expected.

VICTORIA, BRITISH COLUMBIA

Platinum, Manganese, and Gold.—Smelting Rates Raised.

It has been definitely announced by the Hon. Martin Burrell, Minister of Mines for the Dominion, that arrangements have been made with the British government to pay $105 per ounce for Canadian platinum. This is the same as that ruling in the United States, but appreciably higher than the price in Great Britain. It is pointed out that if some action had not been taken in Canada, the efforts of the authorities in developing a supply of the metal might have been somewhat nullified by smuggling it across the United States border, where the price is definitely established.

Some excitement is reported from East Kootenay by the reported discovery of rich platinum and gold placers on Toby creek. There are two parties testing ground, one from Vancouver, the other from Athlamer, the latter town being situated at the junction of Toby creek and the Columbia river. The platinum is said to be flaky, also as nuggets mixed with the coarse gold. High water and rain has delayed development. Residents of the district are hurrying to the place, which is easily accessible.

Mention was made recently in one of these letters to the report that platinum had been discovered by J. Nordquist at the Nome property, Cariboo creek. The first assays made are said to have shown the presence of the metal, but samples sent to the Provincial Analyst failed to disclose platinum. The owner now has taken out a quantity of the ore, divided it into six parts, and intends distributing these specimens among reputable assayers with a view to establishing definitely whether or not he has platinum.

A manganese deposit in the Cowichan district of Vancouver Island promises to prove of considerable importance. Samples tested by the Provincial Mineralogist are said to indicate ore of just the character required. A Vancouver firm's certificate shows 46.20% Mn, 26.92% SiO_2, and 0.064% P; an assay from Seattle reads: 54% Mn, and 18.4% SiO_2. G. C. McKenzie, of the Geological Survey, is making an inspection.

The Consolidated Mining & Smelting Co. has announced further increases in smelting charges. Following is the company's latest statement, dated July 31:

To Lead Ore Shippers:

Since schedule B, lead-ore rates was published, we have been obliged to pay 40c. per ton more for coke to the collieries, which, under that schedule, amounts to an increase of 10c. per ton of ore. In addition to this there may be an increase of freight on coke, but we are not certain yet of this, and there will be a further increase in price effective August 1.

We have been obliged to increase the wages at the smelter by 30c. a shift, so that there is an increase of 45c. per ton under schedule B on this account.

Effective August 1 we will therefore increase the base rate under schedule B by 55c. per ton, plus 25% of the further increase in coke price and freight.

Effective August 12 rates from lead from Tadnac have been increased to $14.30 to Toronto and $16.50 per ton to Montreal. The increase in freight-rate from that which prevailed at February 1 is, therefore, $2.30 per ton on shipments to Toronto and common points and $4.50 per ton to Montreal and common points. Commencing with shipments received here in August we shall be obliged to make an adjustment on account of this freight increase.

As there is considerable difference now between the Montreal and Toronto freight-rates, and it is impossible to forecast the distribution owing to variations in munition demand, we, therefore, as the simplest plan, make this adjustment commencing with the ore received in August, by reducing the lead settlement price by the actual increase in the lead freight-rates.

We will advise you as soon as possible of the amount of the further increases in coke price and freight.

THE MINING SUMMARY

ALASKA

Anchorage.—The Alaska Engineering Commission hopes to connect Seward and Anchorage by rail by September 15. Good progress is being made in spite of the shortage of labor.

Juneau.—Alaska Gold Mines reports as under for the second quarter of 1918, compared with the previous period:

	Second quarter	First quarter
Ore milled, tons	309,249	469,695
Recovery, per cent	81.96	79.92
Gross value, per ton	$1.16	$0.98
Tailing, per ton	0.21	0.19
Recovered per ton	0.95	0.79
Cost per ton	1.00	0.81
Loss per ton	0.05	0.02
Total loss	$14,247	$8,018

The estimate of broken ore in stopes is 1,901,394 tons. Scarcity of labor continues to prevent new development. The plant in all departments is in excellent condition.

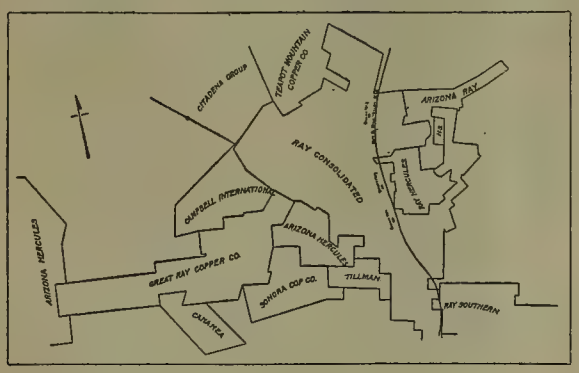
Kennecott.—The Kennecott Copper Corporation pays $1 per share on September 30.

ARIZONA

Bisbee.—Calumet & Arizona pays $2 per share on September 23. This makes $6 for the current year.

Chloride.—J. C. Rankin has taken over the Tintic and the Merrybelle mines. A hoist has been erected at the former. Sinking will commence as soon as the shaft is unwatered. A tunnel is being driven in the Merrybelle.

J. H. Aagard of Los Angeles has taken an option on the Tuckaho mine. A hoist from an Oatman mine is being put up, as well as compressed-air plant.



PROPERTY MAP OF THE RAY DISTRICT, ARIZONA

Geronimo.—The Inspiration Central Mining Co., according to the manager, J. A. Karlson, has opened 20 in. of high-grade copper-silver ore. The mine is in the Turnbull mountains, 10 miles from Geronimo, the shipping point.

The Mt. Turnbull Copper Co., adjoining the Inspiration Central, is to sell shares—to purchase machinery and continue development. C. B. Barnhard of Phoenix is manager.

Ray.—The new mill of the Ray Hercules is concentrating 500 tons daily, about one-third capacity.

Humboldt.—Consolidated Arizona Smelting Co. pays a dividend of 1% on September 14.

Jerome.—The United Verde Extension new smelter is now reducing 400 tons of ore daily.

Kingman.—The Yucca Tungsten Co. is now employing 40 to 50 men, shipping a carload of concentrate every 35 days.

The Standard Minerals Co. is receiving machinery for a 50-ton mill, which is expected to be in operation by November.

Patagonia.—The mill at the Hardshell mine is now turning out 10 tons of manganese concentrate daily.

Tucson.—The secretary of the Pima Smelting Co., G. Meyers, announces that arrangements for the financing of this plant, to be erected here, have been completed, and that the company is awaiting permission from the Finance Board. The plant is expected to be in operation in four months. Contracts for the purchase of 250 tons of ore per day have been signed with local companies.

COLORADO

Central City.—The Gilpin-Eureka Mines Co. continues aggressive development. The main shaft is down 720 ft. below the surface. The new 700-ft. level is being extended on both sides of the shaft, and is now in 250 ft. west and 150 ft. east. Stoping has begun on the 700-ft. level west at the junction of the rich Grabmair stope, which furnished $104 ore on the 600-ft. level. A rich shoot of smelting ore has appeared on the 700-ft. level east. This vein was cut 10 ft. from the shaft, where it was no wider than a knife-blade, but has continued to widen, and is now 15 in. at a point 150 ft. east of the shaft. An average sample was assayed by J. C. Kimball, of Central City, valued at $36.80 per ton, principally in gold and silver, but with profitable quantities of copper, lead, and zinc. Percy R. Alsdorf, of Central City, has been engaged by the company to superintend installation of a flotation plant in the company's mill. A telephone system will be installed in the Gilpin-Eureka, connecting the different working levels and stopes with the shaft-house and manager's office in the mill. E. L. Clark is general manager of the company. A bond-issue of $40,000 is being financed for the company by the Platt Brothers Co., of Cincinnati, Ohio. The proceeds are to be used to install the flotation plant, also to carry on an extensive development program. The main-shaft is to be sunk an additional 300 ft., and the various levels fully opened.

De Beque.—It is reported that there is renewed activity in the oil-shale fields. The American Mineral Oil Co. is arranging to send in plant to its property on Roan creek. ——The Mt. Blaine Oil Shale Co. has built a road, and is excavating for its equipment.——The Colorado Oil Chemical Co. is busy north of De Beque.

Leadville.—Re-opening of the Newell shaft by the C. J. Dold Mining Co. is of importance to this district. With the Northern shaft the company will have two outlets 640 ft. deep. The daily output is 50 tons of lead-silver and manganese ores, mostly the latter; but this is to be more than doubled. Forty-five men are employed.

Ouray.—C. R. Wilfley will continue to operate the Barstow mill here, concentrating fluorspar as well as gold and copper ores.

IDAHO

Metal production of this State in 1917, compared with 1916, according to C. N. Gerry of the U. S. Geological Survey, may be summarized as below:

	1917	1916
Mines producing	359	418
Ore treated, tons	2,758,507	2,718,045
Gold, ounces	38,933	53,977
Silver, ounces	12,029,338	12,300,873
Copper, pounds	7,827,574	8,478,281
Lead, pounds	393,559,521	375,081,781
Zinc, pounds	79,854,136	86,505,219
Total value	$54,845,153	$48,767,783

Shoshone county—the Coeur d'Alene region—accounted for 91% of the total value, followed by Custer with 3%, Lemhi with 1.6%, and Blaine with 1%.

Arco.—The Wilbert Mining Co., operating in the Dome district, 40 miles from here, reports that during the year ended May 16, 1021 tons of lead ore was shipped direct to smelters and 3125 tons milled yielded 893 tons of concentrate. Settlements totaled $133,477. The new incline shaft is down 429 ft., with 135 ft. to connect with an old stope below the 500-ft. level. Eventually the shaft will be 830 ft. deep, and will save $2000 per month compared with the present system.

Mullan.—The Federal M. & S. Co. pays 1¾% on its preferred shares on September 15. This is equal to $209,757, making $629,271 for 1918, and $14,555,723 to date. The total paid to common shares is $2,708,750.

Wallace.—The Hecla company pays 15c. per share, equal to $150,000, on September 28. During the first six months of 1918, sales of ore totaled $2,162,021, of which $1,429,521 was profit, less $290,480 for construction, etc.

KANSAS

Baxter Springs.—The new 300-ton mill (per 10 hours) of the Silver Fox Mining Co. is working well, making a good recovery. Joplin, Galena, and Oklahoma men are interested.

A rich mine is being opened by the Mississippi Queen Mining Co. just south of town. Eleven drill-holes showed ore from a depth of 40 to 120 ft. A shaft is being sunk. Hand-jigs are cleaning some ore extracted. W. H. Berry is manager.

MICHIGAN

Houghton.—Calumet & Hecla reports the following outputs in July:

	July, lb.	7 months, lb.
Ahmeek	1,885,705	15,861,925
Allouez	590,449	4,563,303
Calumet & Hecla	5,284,105	41,376,383
Centennial	193,006	1,525,891
Isle Royale	1,279,579	8,602,675
La Salle	140,706	1,154,350
Osceola	1,398,216	9,698,871
Superior	130,666	1,127,197
White Pine	215,994	1,588,684
Total	11,118,426	85,499,279

Good progress is being made with the Calumet & Hecla flotation plant at Lake Linden.

MISSOURI

Joplin.—Production of the region last week was 5383 tons of blende and 1064 tons of lead, averaging $60 and $100 per ton respectively. The total value was $422,573, making $16,242,872 for 34 weeks. Missouri contributed $111,107 last week.

The Clear-Peacher Mining Co., three miles east, has a richer zinc silicate (calamine) mine than most of this class here. An average of 28 ft. of ore is being mined at a depth of 107 ft. Timber for underground is cut on the lease. A 100-ton mill is producing 16 tons of 43.2% zinc concentrate daily, selling for $43.50 per ton. Fletcher Clear is in charge.

Oronogo.—One of the largest concentrating plants in the United States, that of the Connecticut Zinc Corporation on the Oronogo Circle mine, is almost ready for work. On the 240-ft. level of the mine is a No. 8 McCully gyratory crusher, capable of breaking a 20-in. piece of ore. A shovel with 2½-ton dipper fills the 5-ton side-dump ore-cars underground. According to the Joplin 'News Herald', the new mill is of 2500 tons capacity in 24 hours and is equipped as follows: Two 24-in. Webb City-Carterville crushers, two sets of 60-in. rolls, four sets of 40-in. high-speed rolls, eight Akins classifiers, nine jigs, two six-cell roughers, two four-cell bull-jigs, two five-cell secondary roughers, one seven-cell sand jig, two six-cell cleaners, 27 sludge-tables, five Dorr thickeners, and a complete oil-flotation plant. This equipment is arranged with the idea of handling the ore only once and the Akins classifiers direct the different sizes to the proper machines. The power-plant consists of 900 hp. of steam and 1250 hp. connected load of electric power. The mill proper is driven by a 500-hp. Corliss steam engine, and the sludge room is driven by a 200-hp. motor. There are five Scotch-marine boilers, aggregating 625 hp. All ore is crushed underground to pass a four-inch ring and hoisted in a shaft that contains two skip-ways and one man-way. Skips have a capacity of five tons each. Ore is then conveyed to a 2500-ton hopper by means of a belt-conveyor. From this hopper it is again conveyed to the mill by a similar conveyor. Locomotives are being used underground for tramming and a 1000-ton hopper has been constructed underground to take care of the crusher output. A sludge-pond has been constructed to cover 100 acres of ground with a body of water 4½ ft. deep. The mill was expected to be ready by about August 20.

MONTANA

Butte.—The president, A. J. Seligman, of the Butte Copper & Zinc Co. states that the July production of manganese was over 9000 tons, the largest to date. Zinc-ore production

NEW 2500-TON MILL OF CONNECTICUT ZINC CORPORATION AT ORONOGO, MISSOURI

was 2000 tons, higher in zinc, lead, and silver content than in previous months. August so far maintains the above rate of shipments. The reduction in the freight-rate on manganese ore ordered by the Government recently, will be of great benefit to this company.

Cooke.—Shareholders of the Montana Scotch Bonnet company, mostly Spokane men, will get $150,000 as the result of a deal consummated, at which Robert McKay of Livingston, the purchaser, paid $1000 to bind the bargain. Payments extend over a period of five years. The disbursement will be about five cents per share. This property has been quite inaccessible. It is understood that a railroad is to be built from Gardner through a corner of Yellowstone Park to Cooke and that the building of the line and securing these options for mines are contingent. The Scotch Bonnet will be reached by about 60 miles of the road.

NEVADA

Goldfield.—The manganese property of J. Gaillac and M. Kusick on the Lida road, 7 miles south of Goldfield, has been purchased by Carl Fuetsch through A. E. Barnes. A large deposit of high-grade ore is said to exist.

Luning.—Midway between this place and Hawthorne, F. B. House is mining barium. So far he has shipped 1250 tons, selling for $4.50 per ton on cars at Kinkead siding. Work is conducted to a depth of 30 ft. The vein is from 2 to 7½ ft. wide. A mile and one-half from this mine the Nevada Ore & Copper Co. has a 100-ton mill treating gold-copper ore. Old tailing amounting to 16,000 tons is to be treated.

Thompson.—The Mason Valley company's copper output in July was 1,190,177 pounds.

Tonopah.—During July the Extension treated 9520 tons of ore, yielding 115,215 oz. of silver and 1101 oz. of gold. The profit was $45,542.

Last week the Belmont shipped 93,457 oz. bullion and 32 tons of concentrate, valued at $128,000.

A rich streak of ore is being followed on the 850-ft. level of the North Star.

The Rescue has opened two veins at 1050 ft. On the foot-wall vein a 30-ft. winze has followed 2 ft. of ore, assaying from $80 to $150 per ton.

All lessees in the Montana are doing well, and the company finds this the most satisfactory way of working the mine at present.

OKLAHOMA

Miami.—Following the decision to form an ore exchange here, three or four ore warehouses are to be built, costing over $80,000. They will be equipped with weighing apparatus and conveyors to load cars quickly. The first warehouse, at Picher, will be finished within 40 days.

Picher.—Production of all districts last week totaled 2969 tons of blende and 873 tons of lead, valued at $268,626.

UTAH

Metal production of Utah in 1917 reached the high value of $99,328,000, according to preliminary figures just made public by the U. S. Geological Survey. This is a record for the State. The shipment of ores and concentrates during the first six months of 1918, according to V. C. Heikes, were, however, less than those of the corresponding period in 1917. Production was affected by severe winter weather, higher costs, shortage of labor, and smelter embargoes. The prices of metals, except silver, were lower than in 1917. Larger shipments were being made from Beaver county and from the Park City region in the first half of 1918 than in the later part of 1917, but decreases are noted from Tintic and Bingham. The mines at Park City were shipping 9000 tons of crude ore and concentrate per month during the early part of 1918. In the Tintic district shipments decreased to about 28,000 tons. The increase in the output of lead at Park City may offset the decrease in that of the Tintic district. Most of the lead produced in Utah comes from Bingham, where no increase has been made in 1918. The prospect is not favorable for an increase in the output of zinc. The four smelting plants in Utah are active, but apparently no effort has been made to increase the present rate of shipment of ore.

Alta.—Michigan-Utah shipped 34 cars of ore up to the third week in August, 28 being by the Triangle Leasing Co. The first manganese has been sent out, this carrying 41.92% Mn.

Eureka.—The Chief Consolidated, in the second quarter of 1918 made a net profit of $294,100. Dividends this year total 32½c. per share, equal to $287,372. All development amounted to 2693 ft., one the 1000, 1600, 1800, and 1900-ft. levels. Generally, results were satisfactory. Diamond-drilling is under way from the surface. A new 3-compartment shaft is being sunk 3600 ft. east of the present shaft. Shipments consisted of 9057 tons of lead ore, 8550 tons of 'dry' ore, 26 tons of zinc ore, 217 tons of zinc-lead ore, and 189 tons of manganese ore. Excluding the manganese, the average value was $48.19 per ton. Cecil Fitch is superintendent.

Fish Springs.—The new 200-ton mill of the Utah Mine Co. here, in Juab county, will be working by mid-September. H. Linke is superintendent.

Monroe.—Manganese deposits near this place in Sevier county, and near Marysvale in Piute county, were recently examined by V. C. Heikes of the U. S. Geological Survey. These deposits lie along the eastern boundary of Sevier valley, at the base of Sevier plateau, which is underlain by igneous rocks, chiefly Tertiary tuffs and lavas. The Loring deposit is 6 miles south of Monroe, near the base of Monroe peak. The nearest shipping point is Elsinore, on the Denver & Rio Grande railroad, 8 miles distant. Nine carloads of ore were shipped from this place in 1916 to smelters at Dunbar, Temple, and Washington, Pennsylvania. Assays of two carloads of the ore showed that it contained 35% manganese, 6.6% silica, and 8.57% of iron. The ore occurs in cracks and crevices of weathered igneous rock, and has been obtained by stripping the overburden from an area 600 ft. long and 200 ft. wide to a maximum depth of 16 ft. The deposit may extend several thousand feet north and south beyond the open pit, for rich float was found on the surface through this distance. The ore is soft and is probably wad, a mixture of manganese and iron oxides. Small lenticular masses of manganese and iron oxides in tufa have been found a short distance east of Monroe but have not been mined. The deposits were probably formed by hot springs. Near the mouth of Manning canyon, 10 miles south-east of Marysvale, there is a deposit of manganese ore, owned by Krotki & Sandberg, of Marysvale. The ore is exposed in four open-cuts, but no ore has yet been shipped. The outcrop of the ore strikes N. 65° W., and can be traced for 400 ft. The enclosing rocks are lavas of several varieties, but most of the ore is disseminated through a flow of rhyolite that ranges in thickness from 8 to 30 ft. The principal manganese ore is probably manganite, which occurs in small prismatic crystals, but another form of ore, psilomelane, is disseminated through the rhyolite in veinlets and bunches. The ore is accompanied by calcite and must be concentrated to obtain a marketable product. Water and electric power are available nearby. Small shipments of manganese ore have been made from a deposit near Junction, Piute county, and from a deposit near Pahreah, Kane county, Utah. No detailed information concerning these deposits is yet at hand, but as the cost of hauling ore from Pahreah to the railroad is said to have been $30 per ton the prospect of exploiting them with profit appears small.

Promontory.—The Lake View Mining Co. is again mining zinc and zinc-lead ores. The total output to the time of suspension of shipments was 14,000 tons. Dividends amounted to $137,000.

Tintic.—Twenty mines last week shipped a total of 158 cars of ore.

The Dragon Consolidated earned $9000 last month. The Tintic Milling Co. has a lease on part of the property.

The Tintic Standard continues to open new orebodies, the latest being on the 1300-ft. level.

The North Beck company's shaft is down 1200 ft., where a station is being cut.

The Apex Standard is ready to sink a new shaft at the eastern end of the district.

The Empire has opened new ore on its 1800-ft. level.

WASHINGTON

Chewelah.—The United Copper Co. has made a three-year contract for the smelting of its ores by the Tacoma smelter. According to the president, Conrad Wolfle, it is a contract that will ensure the company good smelter returns whether the War continues or stops. One of the big expenses connected with the company's dealings with the smelter at Trail was the heavy exchange-rate on money between Canada and the United States. This is now avoided and the bother of getting a license to export products is eliminated.

Spokane.—Continued development of magnesite properties, steady shipments of copper, lead, and silver, accompanied by discoveries of tungsten and chrome, all in Stevens county, have stimulated mining activities in all portions of this county, whose richness is just beginning to be realized. Attention has recently been directed to the Deer Trail section in the south-western part of the county, where two companies are shipping steadily and a third expects to be doing so early in August. One truck is making two trips daily from the High Grade mine, owned by the Reardan Copper Co., hauling 3 to 3½ tons per load. The distance to the logging road is 10 miles. The ore goes to the smelter at Trail. Two trucks are hauling from the Deer Trail day and night, making eight trips per day, hauling 3 tons per load. The distance is 12 miles to the logging road. The Bonanza, continuing its cross-cut, has driven 200 ft. since last fall, and is now in 715 ft. from the portal. A 4-ft. vein of ore has been disclosed, assaying $25 to $30 in copper.

CANADA

British Columbia

Anyox.—Granby Consolidated produced 2,167,077 lb. of copper in July, a reduction of 1,300,000 lb. when compared with June, due to the strike. The first converter here has been at work for several weeks, and another is being erected.

Yukon

Dawson.—The 'Daily News' issued its 21st anniversary number on August 17. This contained interesting features of life and mining in the Klondyke. A full description is given of operations conducted by the Yukon Gold Co., also by the Canadian Klondyke Mining Co. Although the temperature was 50° below zero, No. 2 dredge of the latter company worked through last winter.

MEXICO

Sonora

Cananea.—This State is estimated to have produced 10,000,000 lb. of copper in July. Of this, Greene-Cananea contributed 5,000,000 lb. and the Moctezuma 4,000,000 lb. Apart from the difficulty in getting food and supplies, conditions in the copper centres are reported to be satisfactory.

Tigre.—The North Tigre company has ordered a 50-ton concentrating plant to treat the gold-silver-copper ore. F. H. Holmes represents the lessees.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

W. W. Wishon is at Bozeman, Montana.

Charles E. Knox is at Tonopah, Nevada.

F. Lynwood Garrison is at Rock Springs, in Maryland.

W. de L. Benedict has returned from San Francisco to New York.

Percy Williams has returned from Washington to Silverbell, Arizona.

Lewis P. Shackelford, of Juneau, Alaska, is at the St. Francis hotel.

Sanford Rudolph has enlisted in the Engineer Corps and is now in France.

Victor Rakowsky, of Joplin, is here. He is exploiting a chrome deposit in northern California.

Lester C. Uren is Captain in the Chemical Warfare Service of the A. E. F., and is now at New York.

John F. Beavis, operating mines in the Philippine Islands, is residing temporarily at Berkeley, California.

W. H. Emmons, Jr., is Operations Director of the Government's nitrate plant at Muscle Shoals, Alabama.

Philip N. Moore returned from Alaska in time to attend the meeting of the Institute at Colorado Springs.

Sir **John W. Carson**, president of the Crown Reserve Mining Co., recently inspected the Alice property at Idaho Springs, Colorado.

Charles W. Merrill is here on a visit from Washington, where he is Chief of the Collateral Commodities Division of the U. S. Food Administration.

W. H. Blackburn, superintendent for the Tonopah Mining Co., returned last week to Tonopah from a visit to the company's Eden mine in Nicaragua.

Corey C. Brayton has returned from Salt Lake City to San Francisco to take the examination for a commission in the Engineers Corps of the Army.

Edwin Young has been appointed welfare engineer for the Great Falls reduction works of the Anaconda company. He has given 28 years service to this plant.

J. P. Montague has resigned from the Union Amalgamated Mining Co., at Manhattan, Nevada, to take a position with the Ray Consolidated Copper Co. at Hayden, Arizona.

Courtenay De Kalb attended the Gold Conference of the Northwest Mining Association as a delegate from the American Gold Conference, held recently at Reno, Nevada.

Manuel Eissler, on his return voyage to Hongkong, suffered a paralytic stroke and is now in the Chefoo hospital at Shantung, China. We are glad to add that he is recovering from the shock.

J. C. Nicholls, superintendent of mines for the International Nickel Co. of Canada, accompanied by **J. W. Rawlins**, metallurgist to the same company, are inspecting copper-concentrating plants in Arizona.

F. A. Malins, mill-superintendent for the Dos Estrellas Mining Co., at El Oro, Mexico, has returned to his work after two months spent in a Mexico City hospital followed by three months at Corpus Christi, Texas.

Victor G. Hills is engaged with the engineers of Summit and Eagle counties, Colorado, in extensive surveys of the mountain ranges dividing the waters of the Arkansas, Platte, Eagle, Ten Mile, and Blue rivers. He is now at Leadville.

F. H. Flynn, general superintendent for the Smelting & Refining Departments of the Consolidated Mining & Smelting Co. of Canada, Ltd. at Trail, B. C., has resigned. Mail addressed care of the American Institute of Mining Engineers, at New York City, will be forwarded.

THE METAL MARKET

METAL PRICES

San Francisco, September 3

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	16
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11
Zinc-dust, cents per pound	17½

ORE PRICES

September 3

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$25

EASTERN METAL MARKET

(By wire from New York)

September 3.—Copper is unchanged. Lead is scarce, but without change. Spelter is inactive and easier.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 49½ pence.

Date	New York, cents	London, pence
Aug. 28	101.12	49.50
" 29	101.12	49.50
" 30	101.12	49.50
" 31	101.12	49.50
Sept. 1 Sunday		
" 2 Holiday		
" 3	101.12	49.50

Average week ending	
July 23	99.62
" 30	99.62
Aug. 6	99.62
" 13	99.62
" 20	100.25
" 27	101.12
Sept. 3	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	....
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date	
Aug. 28	26.00
" 29	26.00
" 30	26.00
" 31	26.00
Sept. 1 Sunday	
" 2 Holiday	
" 3	26.00

Average week ending	
July 23	26.00
" 30	26.00
Aug. 6	26.00
" 13	26.00
" 20	26.00
" 27	26.00
Sept. 3	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.05	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
Aug. 28	9.37
" 29	9.50
" 30	9.50
" 31	9.37
Sept. 1 Sunday	
" 2 Holiday	
" 3	9.37

Average week ending	
July 23	8.68
" 30	8.45
Aug. 6	8.37
" 13	8.37
" 20	8.60
" 27	9.16
Sept. 3	9.42

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

Zinc-ore prices were stronger at Joplin, Missouri, last week, when second-grade concentrate sold for $55 per ton, a gain of $2.50. A car shortage rather held back prices.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date	
Aug. 28	8.05
" 29	8.05
" 30	8.05
" 31	8.05
Sept. 1 Sunday	
" 2 Holiday	
" 3	8.05

Average week ending	
July 23	8.05
" 30	8.05
Aug. 6	8.05
" 13	8.05
" 20	8.05
" 27	8.05
Sept. 3	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date	
Aug. 6	120.00
" 13	120.00
" 20	120.00
" 27	120.00
Sept. 3	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. These prices are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	98.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	....
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ORES (New York)

Antimony: This market is devoid of development.

Ferro-manganese: The War Industries Board is seriously considering the limiting of the number of blast-furnaces now making ferro-manganese and turning these over to making pig-iron, which is very scarce. It is planned also to encourage the production of electrolytic ferro-manganese by providing sufficient manganese ore, of which there appears to be plenty. This will be of interest to Pacific Coast smelters. There are now four companies producing electrolytic ferro-manganese in the country, two on the Pacific Coast, one in Colorado, and one in Alabama. The output of domestic ferro-manganese in July, according to 'The Iron Age,' was 31,400 gross tons, the second largest month on record, May having shown 35,790 tons. The spiegeleisen output was 20,362 tons in July, a record for the year. 17,844 tons having been made in May.

Manganese: Brazilian ore, about two cargoes, has sold at $1.35 per unit, which seems to be the maximum quotation, as no higher bids were obtainable. A cargo of Indian ore reached this market last week, some sold months ago.

Molybdenum: Quotations remain nominal at $1 per lb., with improved inquiry.

Tungsten: Consumers are in the market for delivery during the remainder of this year and into 1919, but are reported as not very successful in placing orders. There has been a fair business in spot delivery. High-grade ores have brought $25 to $25.50 per unit, with low-grade ores down to $20. Ferro-tungsten is quiet, most consumers being well covered. Quotations range from $2.35 to $2.45 per lb. of contained tungsten.

Eastern Metal Market

New York, August 28.

All the metal markets are still strong though quiet, with copper, lead, and aluminum prices under control.

The demand for copper, as new inquiry, has slackened.

Tin is declining slowly, but is still scarce and firm.

There is a serious shortage of lead.

Zinc is less active, but has advanced.

Antimony is strong and higher.

An imperative appeal has been made to the steel industry in the past week by the War Industries Board for rails, plates, and shell-steel. Unexpected needs of France have added to the stringency, so that the total finished iron and steel estimated as needed in the last half of 1918 is now 23,000,000 tons, against an estimate of 20,000,000 tons a month or so ago, and a probable production of 17,000,000 to 18,000,000 tons for the last half. The recent aggressive activities of the Allies have increased the necessity for more steel. Added to these facts are calls from England, France, and Italy for heavy pig-iron shipment in 1919, concurrent with an acute scarcity in America. Great Britain wants 1,000,000 tons more, of which she is likely to get but little. To make more shell, ship, and rail-steel, some pipe, sheet, and wire mills may have to cut their output. After much discussion an agreement has been reached on rail prices. A flat price of $55 per ton for bessemer, and $57 for open-hearth, may be settled on, subject to change October 1.

COPPER

After the large volume of buying for delivery up to November 1, the time set for the continuance of the 26c. price, there has been relatively little demand. Contracts are reported to have been made for delivery in November and December, but they do not involve large quantities, and are to be only at the price ruling at that time. These are the only news features of the market. A factor on future business is the statement that the U. S. Steel Corporation has placed orders for $5,000,000 worth of electric equipment for its Neville Island gun and projectile plant. This, of course, means a large consumption of copper. Production in July—167,000,000 lb.—was lower than that of June, 175,000,000 lb., due largely to shortage of labor.

TIN

The market has been sagging daily during the past week, and every selling position has been affected. The causes are the fairly large arrivals and the distinct absence of buyers. They manifest no interest, due largely to their desire to await the result of the London conferences, already referred to in these letters. No news regarding this convention has been published yet. An instance of the lower tendency is the fact that October shipments from the Straits is now offered at 78c., compared with 81c. a week ago, 84 to 86c. some weeks earlier, and 97c. per lb. at the peak of the advance some months ago. Even spot or prompt metal is easier, due to the recognition of those having it, which are few, that the market as a whole is lower. For prompt metal the nominal quotation yesterday was 88c., New York, against 92c. a week ago; but little is available. Banca and Chinese brands are held as high as $1 per lb. One large dealer remarked that such holders might have to "eat the metal" ultimately if they persist in their present course. Arrivals at Pacific ports so far this month have been 3425 tons, and at Atlantic ports 2475 tons. The London market is also declining, spot Straits being quoted at £367 10s. per ton yesterday, or £14 per ton lower than a week ago.

LEAD

The scarcity of lead has been mentioned frequently in these letters of late; the situation is acute. So scarce is the metal that August and September delivery are practically unobtainable. Production is not equal to demand, and has not been for some time. An authority states that the output in the first half of 1918 was only 266,874 tons, antimonial-lead included, this comparing with 563,000 tons in the calendar year 1917, and with 570,000 tons in 1916. That these facts are unquestioned is corroborated by the action taken in the past week by the lead committee of the producers, which has been the event of the past few days. Requesting the co-operation of all dealers and manufacturers, the committee's announcement urges strongly the elimination of all non-essential uses of the metal, the discontinuance of accumulations of unnecessary stocks, etc. No pig-lead is to be sold by producers for re-sale in carload lots, and re-melted scrap is not to be sold at higher prices than the current market for virgin metal. It is also stipulated that retail dealers are to be supplied only with the understanding that they are to re-sell to customers whose requirements are in their judgment essential, limiting the price of such sales to ½c. per lb. above the ruling wholesale price. This last stipulation is not satisfactory to dealers who claim that their margin of profit, after costs of storage, haulage, etc., are paid, is too small. It is evident that either consumption must be curtailed or production increased. To accomplish the latter will require several months.

ZINC

The upward movement that started a week or 10 days ago has continued, and yesterday prime Western was quoted at 9.25c., St. Louis, or 9.50c., New York, for September, with October held at 9.12½c., St. Louis, and last quarter at 9c., St. Louis. There have been sales in considerable quantities of prime Western for most of these positions, but in the last day or two demand has slackened perceptibly. Whether the peak of this movement has been reached is a matter of speculation, but it is not unlikely that a slight setback may now appear. But 10c. zinc is not unexpected before the end of summer. The technical position is strong. The Government weekly statistics show a small increase in stocks of the higher grades for the week, and a small decrease in those of prime Western. Government maximum prices for grade A have been continued from September 1 to January 1 at 12c. per lb. with sheet and plate zinc also unchanged for that period at 15c. and 14c. per lb., respectively.

ANTIMONY

The market is decidedly stronger and higher. For prompt or early delivery, New York, duty paid, 14.25 to 14.50c. per lb. is quoted. One cause is the large purchase by Japan of Japanese and Chinese metal, which is said to be selling higher there than in New York.

ALUMINUM

As a result of a meeting in Washington during the past week, maximum prices for No. 1 virgin metal and for scrap have been continued unchanged from September 1 to March 1, 1919. These are 33c. per lb. for 50-ton lots, 33.10c. per lb. for 15 to 50-ton lots, and 33.20c. per lb. for 1 to 15-ton lots. Demand for airplane construction is reported as large, and it is understood that the Aluminum Co. of America recently successfully appealed to the Canadian government to permit it to build an ice barrier in the south branch of the St. Lawrence river at Massena, N. Y., so that production of the metal might continue during the winter.

Company Reports

NEW CORNELIA COPPER CO.

Property: mines and treatment plant at Ajo, Arizona.

Financial Statement: income in 1917 totaled $3,810,123, nearly all from metals. Operations cost $2,007,840, and taxes $128,644. After deducting $911,229 for depreciation, etc., the net income was $762,411. Current assets total $2,297,004, and current liabilities $983,907.

Development: during the year the Ajo Consolidated property was absorbed, increasing ore-reserves considerably. These are now:

Class of ore	Tons	Copper, %
Oxide	12,800,569	1.568
Sulphide	40,302,457	1.587
Total and average	53,103,026	1.582
Ore mined	840,424	1.803
Net reserves	52,262,602	1.579

Production: on June 18, 1917, the first shipment of electrolytic copper left Ajo, and the output for the period was 12,764,848 lb. of electrolytic, 3,316,283 lb. of cement copper, and 3,401,060 lb. of metal in ore, a total of 19,482,191 lb. This was contained in 780,211 tons of ore.

NEW YORK & HONDURAS ROSARIO MINING CO.

Property: silver-gold mines and mills at San Juancito, Honduras, Central America.

Operating Officials: A. R. Gordon, general manager; F. L. Pearce, mine superintendent.

Financial Statement: the 37th annual report, for 1917, shows an income of $1,676,846. Of this, $506,874 was profit. Current assets total $1,505,209, and liabilities $567,784.

Dividends: six, No. 206 to 211, equal to 15% on the capital, amounted to $300,000. No. 1 amortization distribution was made, 5%, equal to $100,000. Total dividends are $4,490,000.

Development: the footage was 9381 ft., a decrease of 3257 ft. when compared with that of 1916. The cost per foot was $12.21. Over a third of this work was on the San Miguel vein, with gratifying results. About 20 veins are worked, the San Miguel North being the largest producer in 1917. Reserves are estimated as 303,296 tons averaging $9.21 per ton, including broken ore and vein fills, a decrease of only 8847 tons. Development was done on three outside properties. A mill is being erected for one. Electric haulage in the main property, with six locomotives, is entirely satisfactory. Hammer drills have replaced the piston type for development.

Production: the twenty 1850-lb. stamp-mill and cyanide plant treated 125,900 tons of ore, averaging $9.84 per ton. Silver extracted was 1,670,612 oz., and gold 13,790 oz., the extraction being 88.31% and 94%, respectively. The total value was $1,111,112, making $24,400,276 since 1882.

Costs: these totaled $7.43 per ton, an increase of $1.13.

WAIHI GOLD MINING CO., LTD.

Property: mines and stamp-mills at Waihi; railroads, mill at Waikino; hydro-electric power-plant and 50-mile transmission-line, in New Zealand.

Operating Official: E. G. Banks, superintendent; W. P. Gauvain, assistant; James Gilmour, mine superintendent.

Financial Statement: receipts from gold and silver, and sundries in 1917 totaled £391,111 ($1,877,000). Operations and administration cost £197,211 ($946,000), leaving a profit of £193,901 ($931,000). With the previous balance there was available £229,252 ($1,099,000), from which was deducted dividends, income-tax £48,248 ($230,000), depreciation, etc., leaving £52,435 ($298,000) carried to 1918. Investments—market-value—are £416,268 ($1,997,000).

Dividends: four, No. 95 to 98, amounted to £99,181 ($475,000). Two dividends, equal to $237,500, were paid in 1918 up to June. Total to date is $24,000,000.

Development: new work amounted to 9249 ft., a low footage due to labor and supply conditions. No work is being done below No. 11 level. Ore is being mined from arches. Reserves total 653,716 tons, a decrease of 110,913 tons. The Cornish pump raised 69,478,500 gal. and the electric pumps 403,791,265 gallons of water.

Production: 200 stamps, 11 tube-mills, sand, slime, and concentrate plants treated 191,742 tons of ore. An average of 121 stamps worked 296 days, also 7.2 tube-mills. The ore assayed 33s.3d. ($7.98) gold and 6s.9d. ($1.62) silver, at total of £2 ($9.60) per ton. Extraction was 93.3% of the gold and 80.3% of the silver, equal to 91.1% of the total value. Concentrate assayed 9 oz. 2.5 dwt. gold and 46 oz. 10 dwt. silver per ton. Extraction from this was 98.1%. Precipitate melted—54,843 lb.—yielded 634,544 oz. of doré bullion, which when refined, yielded gold 999.5 and silver 996 fine. Sales totaled £370,567 ($1,777,000), making £11,878,706 ($57,020,000) since 1890.

BRADEN COPPER CO.

Property: mines, mills, and smelter in Chile.

Operating Officials: S. S. Sorensen, general manager; L. E. Grant, assistant; H. R. Graham, mine superintendent; J. Chambers, railroad superintendent; R. E. Douglass, mill superintendent; W. L. Stevens, acting smelter manager.

Financial Statement: operating revenue in 1917 was $13,041,925, and expenditure $6,699,726, leaving $6,342,199. Other income was $876,937. Taxes and interest absorbed $1,110,749, and other charges (depletion, depreciation, etc.) $3,245,276. The net surplus for 1917 was therefore $2,863,111, plus $406,621 from reserve no longer required and steamship profit, and $6,738,705 balance from 1916. The total of $7,145,325 was reduced to $2,193,628 by depletion adjustments, etc. Adding this to the 1917 surplus above, the balance at December 31, 1917, was $5,056,739. From this is deducted $1,170,000 for discount on bonds, leaving a net earned surplus of $3,886,739.

Development: new openings in the Teniente amounted to 31,135 ft., making 96,195 ft. to date, and 11,868 ft. in the Fortuna, making 130,963 ft. By the end of July 1918 the new main shaft, known as A, is expected to be completed. Development gave very satisfactory results. Reserves are estimated as 149,192,000 tons of 2.42% positive ore and 90,000,000 tons of 1.88% probable ore. This is an increase of 19,512,000 tons compared with the estimate made in November 1916, after allowing for 2,070,000 tons milled.

Production: the mill (using flotation) dressed 1,799,694 tons of ore averaging 2.319% copper, of which 81.61% was saved in concentrate. The smelter reduced 158,275 tons of concentrate, of which 112,549 tons was nodulized before smelting. Total charge reduced was 193,290 tons, coke used being 11.67%. Converters made 87.6 tons of blister per day, against 57.8 tons in 1916. The copper output was 31,887 tons.

General: the railroad carried 115,000 metric tons of material and 60,000 passengers. The 8000-kw. Coya power-plant worked at 35% overload in January 1917, which was maintained until August, when a 4000-kw. unit was added. A big underground station is being cut out in the Teniente mine for 4 direct-connected reciprocating air-compressors of 5000-cu. ft. capacity each. An electric railroad tunnel is the next big work on hand. A 12,000-kw. power-plant is being constructed at Pangal. Large additions were made in housing and welfare facilities. Wages were slightly higher —4.7 to 7%—but on account of exchange, wages in Chile were 35% higher than in 1916 and 53% than in 1915.

Mining Decisions

Grant of Oil and Gas—Includes Right of Entry

The owner of a right to prospect for and extract oil and gas together with the right to use so much of the surface as may be reasonably necessary for operations, deeded nine-tenths of the oil and gas to another. Held, that the deed by implication included the right to enter upon the land, prospect, drill, and extract the oil and gas so granted.

Ramey v. Stephney (Oklahoma), 173 Pacific 72. May 21, 1918.

Mining Location—Abandonment

Re-location by another locator of ground already covered by a valid mining claim, but with the consent of the first locator, is permissible at law, and the court will consider the first locator's consent as tantamount to an abandonment of his claim. If, however, the consideration for his consent was the promise of an interest in the second location, the court in quieting the title of the second locator as against the first location, will also establish by its decree the interest of the first locator in the new location.

Walsh v. Kleinschmidt (Montana), 173 Pacific, 548. June 6, 1918.

Execution Sale—Pipe-Lines Held Personal Property

Pipe-lines for placer mining attached to a water bulkhead and laid over the surface of the ground, and giants attached to the end of the pipe-line, which were taken apart and moved each year and were connected by slip-joints, may be said to be "annexed to the realty" under the rule distinguishing real and personal property; but as it was apparent from the character of their use that the owner did not intend to make them permanent accessions to his mining claim, they should be treated as personal property and not as realty under an execution sale.

Roseburg National Bank v. Camp (Oregon), 173 Pacific, 313. June 4, 1918.

Lode and Placer Locations—Requirements of Law

It is unnecessary for a locator to prove that his claim is a valuable placer mine in order to establish the validity of his placer location. It is enough that he discovers minerals and such indications of value as would justify a person of ordinary prudence in the expenditure of labor and means with a reasonable prospect of success in developing a valuable mine. Where the plaintiff located his claim, made a discovery of gold therein, panned and mined the claim enough every year to perform his annual assessment work, using pans, sluice-boxes, and ground-sluices, he sufficiently established the land as valuable for placer mining. A stone mound capable of ready identification is a "permanent monument" within the meaning of the Act, requiring the boundaries of lode claims to be marked. The notice of location must be posted at the point of discovery.

Batt v. Stedman (California), 173 Pacific, 99.

Forfeiture by Delinquent Co-owner—Proof Required

Where one of two co-owners of a mining claim neglects or refuses to perform or contribute to the performance of his share of the annual assessment work, the other co-owner may, after performing the work, serve a notice upon the delinquent co-owner to contribute his share and if he fails to do so within 90 days from date of service, title to the claim shall vest in the working co-owner, under the provisions of U. S. Revised Statutes, Section 2324. Under Section 14,260, Civil Code of California, the working owner is required to file for record as evidence of his title within the 90-day period of notice, the original notice with proof of service thereon. Failure to record this notice within such 90-day period deprives it of its force as prima-facie evidence of title, and in a cross-action to quiet title to the claim against the delinquent co-owner where it was shown that the notice was not recorded within 90 days, all of the facts upon the basis of which the alleged forfeiture was claimed must be proven by the cross-complaint before the forfeiture can be judicially declared.

Robinson v. Briest (California), 173 Pacific, 88. June 6, 1918.

Lode Location—Black Rock-Elm Orlu Case

Failure to comply with the requirement of an old Montana statute which fixed a twenty-day limit within which location notices should be recorded is cured by subsequent issuance of patent to the claims, and said patent is conclusive evidence that all requirements of law, both State and Federal, relating to location and record have been sufficiently complied with. The Federal Courts are not bound by decisions of the Montana Supreme Court to the contrary, where such decisions were announced subsequent to the location of all the claims in controversy, especially as the State statute did not provide for forfeiture for non-compliance with the recordation requirements.

Failure to adverse a patent application, the plat for which showed no conflict of surface-lines with other claims, does not estop the plaintiff from litigating in court the priority of underground rights.

When the owner of two adjoining mining claims sells and conveys one of them he conveys only that which is granted by the Government when it issues the patent to that claim, and is not estopped by such conveyance to assert extra-lateral rights on the vein of the claim which he retains.

In the absence of proof that two veins converging on the dip, unite, the presumption is that they intersect. The Court was justified in limiting the scope of its decree to proven facts, and in leaving to future development and proof other rights not yet made certain.

Decree of the District Court adjudicating the extent of each ownership on the Rainbow, Jersey Blue, Creden, and Pyle veins affirmed.

Butte & Superior Copper Co. v. Clark-Montana Realty Co. (Montana), 248 Federal, 609.

Recent Publications

Clay Resources of Southern Saskatchewan. By N. B. Davis. Pp. 93, ill., map, index. Department of Mines, Ottawa, Canada, 1918.

The Diffusion of Oxygen Through Stored Coal. By S. H. Katz. Pp. 44, illustrated. Technical paper 170 of U. S. Bureau of Mines, Washington, 1917.

Stratigraphy of the Hanna Basin, Wyoming. By C. F. Bowen. Pp. 9, charts. Professional paper 108-L of U. S. Geological Survey, Washington, 1918.

Tests of the Absorption and Penetration of Coal Tar and Creosote in Longleaf Pine. By C. H. Teesdale and J. D. MacLean. Pp. 41, illustrated. Professional paper, bulletin 607, of U. S. Department of Agriculture, Washington, 1918.

Geology and Paleontology of the Raton Mesa and Other Regions in Colorado and New Mexico. By W. T. Lee and F. H. Knowlton. Pp. 450, ill., maps, charts, 113 plates, index. Professional paper 101 of U. S. Geological Survey, Washington, 1917.

INFORMATION FURNISHED BY MANUFACTURERS

SMOKE PREVENTION IN BURNING COAL

At this time when the conservation of coal is so absolutely necessary everyone realizes that smoke issuing from boiler stacks represents unused heat-units, but everyone does not realize that certain simple rules, if observed in the fire-room, will materially decrease this loss. The suggestions given below are based on many years' experience by the Westinghouse Electric & Manufacturing Co.'s combustion engineers:

1. Give your fireman an opportunity to learn the fundamental principles of burning fuel.

2. If you have a difficult fuel-problem, consult a combustion engineer.

3. Prevent smoke by proper methods of firing.

4. Use gauges to indicate exactly the condition of the fire-bed at all times. As a minimum these gauges should consist of a draft-gauge indicating the draft in the furnace above the fuel-bed, a draft-gauge indicating the draft at the boiler side of the flue-damper, and a steam-flow metre for individual boilers.

5. Carbon di-oxide is the principal product of the complete combustion of coal; 10 to 12% of CO_2 should be obtained in the flue-gases to ensure a minimum loss of fuel.

6. Avoid losses due to unburned coal in the ash.

7. If you are wasting exhaust steam you are wasting coal.

8. Do not permit the grates to become clogged. A systematic method of keeping the air-spaces clean must be followed.

9. Inspect the baffles in the boilers, because broken or leaky baffles raise the flue-gas temperature and waste the coal.

10. Avoid cold air leaking in around the boiler-setting.

11. Install stokers; hand-firing is rapidly being recognized as an obsolete and wasteful method.

12. Clean the scale from the tubes, as every particle of scale represents wasted coal.

13. Avoid formation of soot; all boiler-tubes should be blown externally once every eight hours when in continuous service.

14. All smoke-flues should be as short and as straight as possible. Flues should also be made air-tight, and all joints and connections should be well fitted, caulked, and riveted. Use asbestos gaskets on clean-out doors.

15. Place flue-dampers in front of the boiler so that the fireman will adjust them as required. Dampers placed in the rear of the boilers are seldom disturbed, regardless of the conditions.

16. The size of the coal has much to do with the capacity and efficiency of boilers. In general, the air-pressure penetrates the fuel-bed formed by coarse coal easier than that formed by finer coal, resulting in the disturbance of the best furnace conditions.

In addition to the above suggestions, the following 'don't' list should be observed:

Don't fail to keep the heating surfaces of the boilers free from soot, scale, or oil; don't fail to keep the fires level and free from holes; don't carry the fires so thin as to draw a lot of excess air through them; don't carry the fires so thick as to have incomplete combustion of the coal; don't soak the coal with water before firing; don't fail to make sure that the blow-off valves do not leak; don't have the safety-valve popping continually; don't forget to cover the steam-pipes; don't waste steam through leaky valves or traps; don't use live-steam if exhaust-steam is available and can be used as well.

The observance of the foregoing simple rules and suggestions should materially reduce the consumption of coal of the average plant. The Westinghouse system of automatic stoker, with damper control of air to wind-boxes and to lower fuel-bed, to over-feed section, and with an auxiliary air-duct for the rear dumping-grate gives perfect combustion and insures maximum heating efficiency.

A BLASTERS' HANDBOOK

Explosives are yearly becoming more a necessity for a number of classes of work. They are necessary for mining all the metals, for quarrying stone, for improving means of travel, and for developing farm-lands. The alarm clock that announces getting-up time is made of metal blasted by explosives. The stove on which the breakfast was cooked is made of iron mined with explosives. The coal with which the stove was heated was also mined with explosives. The knives, forks, and spoons with which the meal was served at one time met with an explosive experience. The paving on the street or road is also the result of blasts, for the stone, concrete, or shale of which it is made was blasted from some place in the earth. Railroads are built, ship-channels opened, fields cleared and drained, and soils tilled by explosives. A pocket text-book called the 'Blasters' Handbook' has just been issued by E. I. du Pont de Nemours & Co. of Wilmington, Delaware, which tells in detail how to blow soot from big chimneys, how to break up old boilers and heavy machinery, and how to use explosives for every purpose where their employment is practicable. This book gives valuable information regarding the proper explosive to use, the quantity, and the method of loading and firing. It is profusely illustrated, and contains charts and diagrams that make it a valuable addition to any technical library. It does not go into exhaustive detail in many cases, but cites references to other books. These are: 'High Explosives', sections 1 and 2, which gives detailed information on high and low explosives; 'Blasting Supplies', which covers fully the subject of blasting supplies and their uses; 'Blasting Powder', which describes the uses of blasting-powder; 'Road Building and Maintenance', a treatise on road building; 'Shale and Clay Blasting', dealing with the mining of clays; 'Pole and Post Holes', on digging them with explosives; 'Handbook of Explosives', detailing a variety of uses, especially in drainage and land clearing.

Any of these can be had free of cost, by those interested in blasting, by addressing a card to the Du Pont Co., Wilmington, Delaware.

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Edited by T. A. RICKARD

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Number 11

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EDITORIAL STAFF

T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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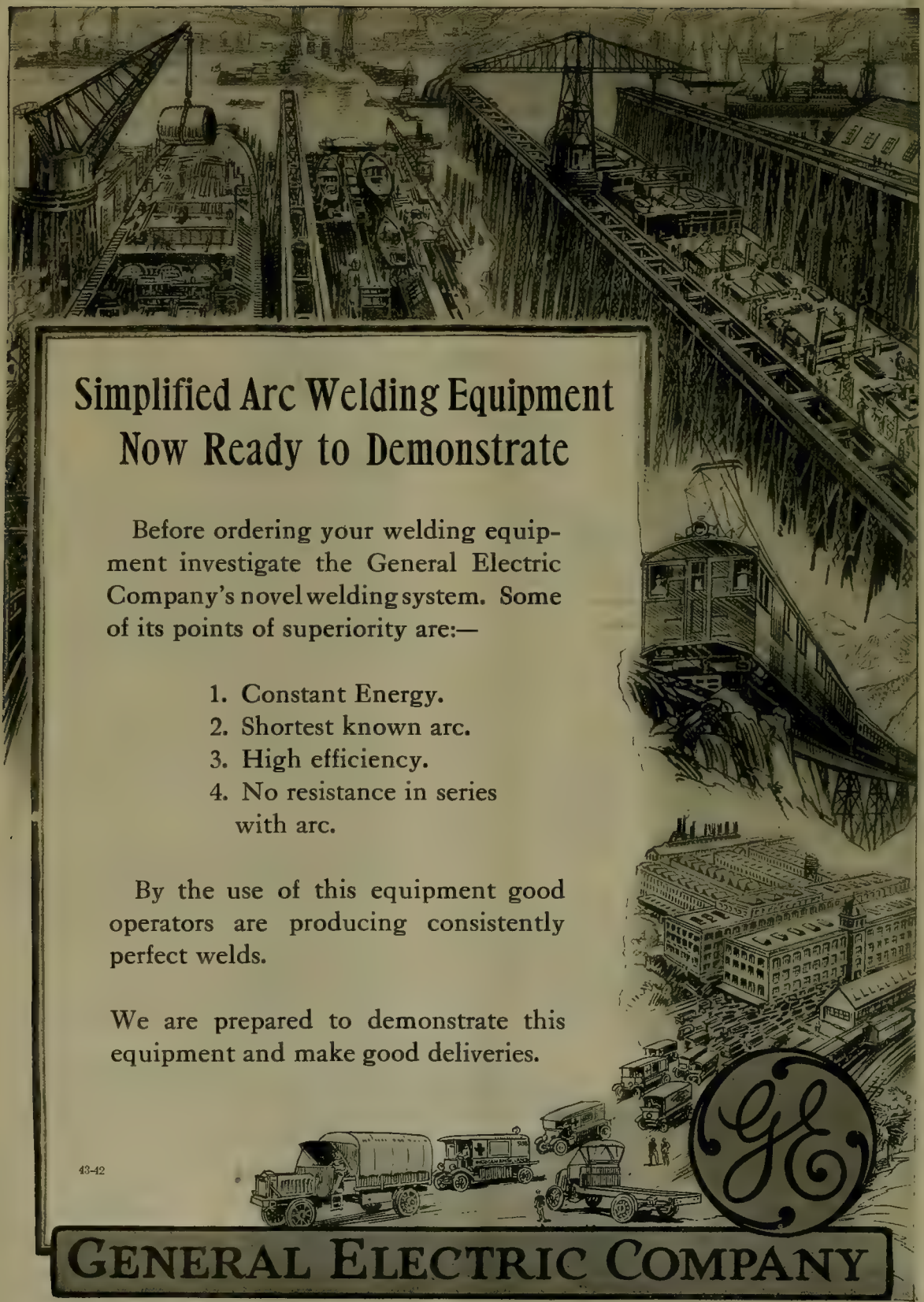

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GENERAL ELECTRIC COMPANY

EDITORIAL

WHILE going to press we received the following important telegram from the Director of the U. S. Bureau of Mines: "The War Department has provided the necessary machinery for the protection of essential industries, like mining, from the indiscriminate operation of the draft, and depends upon the companies and individuals to protect their industries by taking special care to see that skilled labor, which cannot be replaced, receives the proper industrial deferred classification. Mining organizations producing necessary war-minerals should consider it a patriotic duty to attend actively to this matter at once and to take up with their Local Boards the classification in the draft that their key-men should receive. The Army desires to have every man who can be replaced put into a classification where he will be ready to carry a gun as soon as called for, but does not wish to take men who would be more useful for war purposes where they are. Should those engaged in the conduct of essential war mines not carry out this duty promptly the War Department may naturally hesitate to furlough back men from the Army in cases where the companies have neglected to ask for the proper deferred classification for their man as provided for under the selective draft regulations. Machinery has also been created whereby in some instances the key-men in essential industries who have failed for any reason to receive industrial deferred classification may still be returned to their work by the Adjutant General of the Army after their arrival at camp. Under this arrangement the different departments and bureaus representing certain industries may designate a certifying officer who may recommend to the Adjutant General that the soldier in question be granted an indefinite furlough without pay and ordered to report to the industry where his services are needed for the protection of the metal-mining industry. For this purpose the Secretary of the Interior has named Van. H. Manning, Director of the Bureau of Mines, as the certifying officer for the Department of the Interior. This function has been assumed by the Fuel Administration for the coal mining and oil industry, so that the Bureau of Mines will receive only applications for the mining and metallurgical industries, excluding the steel industry." We commend this message to the earnest and patriotic consideration of mine-managers and others in authority. Act at once.

GROWING appreciation of the need for gold is indicated by the Government's order forbidding the mints to issue gold bullion without license from the War Industries Board, this being aimed against the consumption of the metal for manufacturing purposes.

ON another page we publish the text of Senator Henderson's bill, S. 4885, creating a Federal corporation for the purchase of the secondary war-minerals and the encouragement of these essential products. This legislation is a substitute for the War Minerals Bill.

END of the War is a phrase used loosely. Legally it means the date when ratifications of the treaty of peace are exchanged or deposited by the governments of the belligerents, or it may mean the date on which the President issues a message stating that warfare is ended.

AN immense debt of gratitude is owing to our soldiers in France. They have shed new lustre on the name of America, they have given new hope to our gallant Allies, they have made good. It remains for us at home to give expression to our gratitude by backing up their efforts, and that we can do by subscribing all that we can to the forthcoming Liberty Loan.

THE Kaiser and his precious son are commencing to sing in a minor key. One talks about "the sacred soil of the fatherland," as if the soil of Belgium, Servia, Montenegro, or France was not as sacred to the peoples whose territory he invaded as Deutschland is to him and his cohorts. The impudent Crown Prince says that the Germans want "only to hold their own" and they "are fighting for their existence" against the unscrupulous English and their allies, notably the Americans whose knowledge of European geography is so deficient that they do not know where Alsace is. It needs not the seventh son of a seventh son to predict that our boys will know all about the geography of Alsace before the Crown Prince and his army get home.

STATISTICS will prove anything. Thus, a comparison between the world's annual production of gold and the index number of commodity prices shows that in 1897 the production of gold was $237,388,998 (note the

meticulous precision in an estimate that cannot be correct within a million), while the index number was 54, as compared with 100 in 1916, when $458,808,761 of gold was produced. Therefore the increase in gold production was exactly in inverse ratio to its purchasing power. This is an excellent example of 'the long arm of coincidence,' for it would be just as reasonable to argue that the statistics demonstrate how gold production is stimulated by the increasing cost of everything used in producing gold.

STATEMENTS are beginning to appear suggesting that the Germans are undergoing a change of spirit and are becoming reasonable. The evidence available indicates that it is hunger, not moral sense, that has caused the change; it is to their stomachs, not their heads, that they owe an awakening of conscience. The people—not the leaders only—that used a free country as a road to the invasion of another country, the people that approved the deportation and enslavement of civilians, the people that applauded assassination on the high seas and wore medals to celebrate the drowning of the passengers on a non-combatant vessel, the people that backed their governors in piracy on land and sea, such a people is not going to develop a sense of ethics over-night.

IN ten days we have had three holidays, two of which were National and the third a State celebration. There seems little justification for local or State holidays in times like these, and even National fiestas might properly be diminished in number. The boys in the trenches are observing none of these holidays, and the new draft law, meaning 'Work or Fight,' suggests that those unable to fight ought to work as much as they can. The cessation of the work essential to the furtherance of the War in order that a number of persons may indulge in a pseudo-military procession is worse than ludicrous in the face of the grim realities of the moment, when the extra editions of the papers are shouting news of the deadly struggle across the Atlantic. The spectacle of organized idleness and public festivity at such a time makes Nero seem not wholly eccentric.

WE note with pleasure that Secretary Lane has written a letter to the chairman of the Ways and Means Committee of the House of Representatives deprecating "the effect of the excess-profits taxes on the production of certain minerals essential for carrying on the War" and suggesting care in assessing taxes so as not to kill these industries. He mentions "the fact that new mining enterprises of uncertain life are not allowed to amortize the actual investment before becoming subject to the excess-profit tax." This is due to the custom of regarding dividends from mines as income, whereas, as a matter of fact, most of them represent the return of capital. It is only when the mine has redeemed its capital that its dividends are real profit on the 'investment,' or speculation, as we prefer to call it. A mine is a wasting asset and until the yield from it has more than amortized the money sunk in the enterprise it is not a profitable venture, except for those that meanwhile use the stock as a counter for a gamble, selling it for more than they paid for it and for more usually than it is worth.

ELECTRIC POWER is lacking for gold mining, both on the dredges and at the lode mines, the Director of Power for the State of California having combined persuasion and command in an effort to overcome the difficulties created by a shortage of power, yet the full illumination of Market Street is to be resumed on October 1, in order to aid the business of providing pleasure for the gay and irresponsible in this City. It seems to us all wrong to foster the night life, the careless eating and drinking, the promiscuous dancing, and other means for forgetting the serious task the Nation has in hand, while, at the same time, withdrawing the electric energy needed for the production of a metal essential to the furtherance of the national purpose.

UPON pages 29a and 29b we publish a two-page advertisement for the Liberty Loan campaign announcing an organized plan for securing the co-operation of employers in obtaining the necessary subscriptions. The aim is to make every 'boss' an active participant in the Fourth Liberty Bond campaign, by inducing him to create a spirit of personal responsibility among the workers, it being taken for granted that the employers themselves will set a good example. We ask every reader to look at this announcement carefully, whether he be the manager for a mining company, the head of a manufacturing firm, or otherwise engaged in a business placing him at the head of an organization. We are in a position to supply the booklets to which reference is made in the advertisement.

OPTIMISM is becoming rampant, but the victory is not yet won. Much remains to be done and many long battles are yet to be fought, by American armies, among others. As the 'New Republic' says: "Victory will be ours when, and not until, the Prussian way of thinking shall have been eliminated; when it shall have seen itself as futile and unprofitable as we have seen it base. Victory will be ours when the doctrine of the divine right of might shall have been laid at rest wherever it exists the world over. Victory will be ours when the autocratic psychology of force shall have been supplanted by the democratic psychology of consent; when the politics of force shall have given way to the politics of consent." We commend this utterance to the thoughtful consideration of our readers.

IN this issue we reproduce an appreciation of the mining engineer, as typified by Mr. Hoover, taken from 'Common Sense' and written by Mr. F. W. Hirst, who used to be editor of 'The Economist,' in many respects the cleanest and best financial periodical in the English language, and therefore in the world. Mr. Hirst appears to have been *bouleversé* by the War, for today he

is a follower of Lord Lansdowne and a preacher of something closely akin to pacifism, but one cannot doubt his sincerity or the high character of his work as a journalist. In the article that we quote he pays a sympathetic tribute to Mr. Hoover and to the ability of the profession of which our Food Controller is a member. The late Lord Rhondda, the British Food Controller, likewise was an operator and engineer of coal mines, and Sir Charles Fielding, chairman of the Rio Tinto copper company, is now Director-General of Food Production in England.

Conveyors

Mechanical conveying apparatus is a necessary adjunct to milling operations. The design and manufacture of it has developed from an insignificant beginning to a highly specialized industry, and in common with other specialties, is none too well understood by the general practitioner. Mr. Robert S. Lewis, Professor of Mining in the University of Utah, contributes an interesting and instructive article in this issue dealing with the design and application of the conventional types of conveyor. We confess that we never did know the significance of the term 'friction' as applied by the belt-maker to the function of the rubber as a means of holding the canvas layers, or plies, together. It seems to be a colloquialism applied by the belt-maker to his own particular trade. At any rate, it is a term that is used glibly by the salesman with a knowing air that evokes a pardonable curiosity upon the part of the mine superintendent. Mr. Lewis, however, offers a means of determining the efficiency of the so-called 'friction' by a simple test, which is rational, effective, and should enable the prospective purchaser easily to appraise the serviceability of the belt that he is going to buy. The question of the proper position for the drive end of the conveyor is determined by whether the conveyor is horizontal or is expected to elevate and also to convey. If the conveyor is horizontal, it is of no special consequence whether the drive be at the head or the tail end. If the conveyor is set at an angle and is expected to perform the function of an elevator as well, the drive should invariably be at the discharge end. A belt must be pulled up; it cannot effectually be pushed up. It is interesting to note, in Mr. Lewis' article, the copious reference made to the formulas developed by manufacturers; this is only another instance where commercialism inspires scientific research in order to render possible better service for the user. All the engineers in the world are not in consulting practice, and much of the best work that has been done in engineering research has been accomplished in the experimental laboratories and testing-plants of the manufacturer. Too little attention is given by designers to the determination of proper diameter of pulleys. As Mr. Lewis points out, the thickness, or number of plies of the belt, is the governing factor; too small a pulley in proportion to the thickness of the belt lessens the life of the belt greatly. There is another factor influencing the length of service obtained from the belt, and that is age. After a time, the rubber loses its elasticity, it hardens and cracks. This occurs whether the belt be in use or not; in fact, idle belts seem to succumb to the ravages of time more rapidly than those in constant use, in which respect they are similar to the human machine. Why is it that lagged driving-pulleys are not used more frequently? Wood or rubber-strip lagging may be employed to good purpose; it greatly diminishes the loss of power due to slippage. This is especially true wherever the troughing-belt is used to elevate as well as to convey, and the degree of elevation approaches closely to the critical angle beyond which the material will not cling to the surface of the belt. Chutes feeding belt-conveyors should be set at such an angle as to minimize the abrasive effect of the material upon the belt, and, if the material fed is ore in comparatively large particles, some sort of hinged baffle should be placed in the chute to break the force of impact on the belt. Belts are costly, especially at the present time, and every possible care should be exercised to obtain the utmost service from them. 'Dusting,' where fine dry material is conveyed, is another cause of destruction, especially to bearings. The compression grease-cups should be inspected daily and kept filled. Keep the dust and dirt outside; there is no objection to the spectacle of grease exuding from the space between the pulley-hubs and the bearings, in fact, it is an excellent surface indication of good lubrication inside.

The Spokane Gold Conference

If a point of distinction were to be drawn between the fruits of the two recent conferences in aid of gold production, it would be that the predominant importance of the gold output to the financier was more forcibly accentuated at the meeting in Spokane. This is not to imply that the American Gold Conference was not keenly conscious of the value of gold as a basis for currency and credit-expansion; the entire argument of that body for relief to the gold miner was based on the need of new gold as an addition to the reserve in the Treasury. For this they had the unqualified dictum of Secretary McAdoo; but the banking interests had not joined in the plea for assistance to save the languishing gold industry. The representatives of actual production, in fact, had not before assembled; their difficulties had not been made known in an authoritative manner; only in a vague way was it realized that something was wrong at the source of our financial stream. The conference at Reno therefore stated the case of the gold miner for the first time in a large and impressive form, and the gravity of the peril was enforced upon the attention of our people. The International Gold Conference, called by the Northwest Mining Association at Spokane, on the other hand, was supported in a notable manner by the first clear voice on behalf of the gold producer that has come from the commercial bankers of the country. A meeting of the promi-

nent bankers of the North-West and of California met at Portland on September 5 for the express purpose of recommending that action be taken by the Government to sustain the production of gold at a volume undiminished from that which had existed before the War. Emphatic resolutions to that effect were passed. It is pleasing to record, moreover, that there was no collusion between the bankers and the gold miners in this matter. So independent were the two movements for a discussion of this question that arrangements for the respective conferences had been made before either group became aware of the other's intentions and the dates for the meeting were found to coincide. The action of the Pacific Coast Bankers Gold Conference has fairly launched the propaganda for Federal assistance to gold mining in the financial world, and we understand that further steps were taken to ensure ample consideration of this serious problem by the American Bankers Association at Chicago later in the month. The American Gold Conference also will be represented at that meeting.

At Spokane the influence of the Portland meeting was clearly seen. The deliberations concerned the financial aspects of gold production and its importance in expanding credits. It was pointed out that the commercial credits extended by our banks at the present time amounted in many cases to twenty times the volume of gold on which they were founded, and that in times such as these it was not remarkable that such should be the fact. If that ratio prevail widely, as it is believed to do, the value of the normal annual output of domestic gold in our commercial relations would exceed two billions of dollars. Thus its importance rises to the highest class among the commodities of all sorts produced in the United States. On the other side of the question, the Spokane conference dwelt more elaborately on the details of the ways and means that might contribute to the salvation of the gold industry, and it quite firmly put itself on record in favor of the payment of a bounty as the most feasible and practicable method. The distinction also between the payment of the official price of $20.67 per ounce for the new gold actually sold to the Mint and of a bounty on presentation of proofs of production and delivery, as a reward for services rendered in sustaining the gold reserve, was clearly made. The work of the International Gold Conference was highly constructive and was conducted along broad lines, which will give weight to the opinions expressed. They fully represented the larger mining interests in the North-West, and Canadian delegates added to the strength of the meeting, giving it a valid reason for calling itself 'international.' One gratifying outcome of the proceedings was the frank and complete endorsement of the platform of the American Gold Conference and the decision to co-operate with it in all efforts that may be made to secure favorable action by the authorities at Washington. By thus recognizing the necessity for union among the gold miners, and by making common cause, the facts concerning the needs of the gold industry and a proper measure of the remedy to be applied, can be more quickly and definitely ascertained by the officials of the Treasury Department and others who will have to deal with the legislative problems involved. The Northwest Mining Association has rendered a distinct aid to the gold producers and to the country by its convention.

The Second Draft

Last Thursday the new draft went into effect and every man between the ages of 18 and 45 had to register. Congress has seen fit to mobilize the manhood of the country, so that all the human power required for the national purpose may be available for use in the ratio of one man at the front to four men at home working. This last word is emphatic, for the new draft law is equivalent to a mandate of 'work or fight'; it is a conscription of labor, no less than a military muster, the intent of it being to compel the slacker to do his share either in the trenches or in the factory. This law, supplemented by the organization of the Employment Service Bureau, will have the effect of rendering idleness difficult, if not impossible, although it must be admitted that as one man can lead a horse to water and twenty cannot make him drink, so Congress may compel a man to go to work, without succeeding in making him work. One of the scandals of the day is the manner in which abnormal wages are being paid to men that are able to so terrorize their foremen and overseers as to give only a fraction of the labor for which they are paid. The efficiency of labor, notably in the shipyards and munition plants, is said to be painfully low. That, however, is another story. The new draft law will not cure this evil so long as the labor leaders wink at it, but the broad result is to place American manhood on the economic firing-line. Those whom the French call *embusqués*, that is, occupying posts of safety in the rear, as, for example, in offices at Washington, will be smoked out into vital effort, their places being taken by older men, unfit for a higher service, for, talk as you may, there remains no service so great, no sacrifice so real, as that of the man who risks his life in battle, on land or sea. Popular sentiment is wrong in rating the man in the shipyards and factories, in the mines and in the fields, as the peer of the soldier; the holiday-makers that paraded our streets on Labor Day are not the equals of those in Pershing's army, and no amount of verbal camouflage can obscure the fact. Will the children of today think as much of the man that earned $10 per day in a shipyard as of the man that for the nominal pay of $1 per day crossed the sea to fight the Germans? No; and that is why we say that the future of the United States, as of the other Allied countries, is not destined to pass into the hands of Labor, however big you make the L, but it will be in the hands of the clear-sighted courageous young men that will come back from the War, ennobled and intensively educated by the most inspiring experience that falls to the lot of an intelligent citizen—to fight successfully for a great cause.

International Gold Conference at Spokane

By COURTENAY DE KALB

Two simultaneous meetings have been held in the North-West that have once more brought into prominence the urgency of the necessity for early Federal action to save the gold industry from dwindling to insignificant proportions. These were the convention of the bankers of Oregon, Washington, and California, under the auspices of the Oregon Bankers' Association, at Portland, on September 5, and that of the International Gold Conference, called by the Northwest Mining Association, in session at Spokane, Washington, on September 5 and 6. This is the first instance in this country of a convention of bankers definitely calling attention to the need of stimulating the output of the gold mines, in order to protect the Treasury's gold reserve. The meeting was representative of the larger financial interests of the three States mentioned. The chief topic of discussion was the need of more gold as a basis for credits, and a paper analyzing the present position of the finances of the country, with special reference to the gold-reserve, was presented by John Clausen, vice-president of the Crocker National Bank of San Francisco. Resolutions voicing the importance that the convention attaches to protecting and aiding the gold mines were adopted as follows:

WHEREAS, Secretary of the Treasury, William G. McAdoo, has called the attention of the country to the necessity for the largest possible output of gold, in order that the credits of the country may be stabilized, and

WHEREAS, reliable statistics show that the gold production of the world declined from $469,000,000 in 1915 to $430,000,000 in 1917, and that of United States from $101,000,000 in 1915 to $84,000,000 in 1917, with a still further decline for 1918, estimated by reliable authorities to be $11,000,000 based upon the production for the six months ending June 30, 1918, and

WHEREAS, this decline in production is due largely to the fact that the cost of producing gold as a commodity has exceeded the fixed monetary price of $20.6718 per ounce for the major portion of the domestic gold produced; now, therefore, be it

Resolved by the bankers here assembled that they heartily approve of the appointment by the Secretary of the Interior of a committee to study the increased cost and the decreased output of gold in order that the gold production of the United States may be maintained at its pre-war volume.

It may be noted that the active interest of E. G. Crawford, vice-president of the United States National Bank of Portland; A. L. Mills, president of the First National Bank; and Edward Cookingham, vice-president of the Ladd & Tilton Bank, both of the same city, was responsible for this notable gathering, which has taken the lead among the banking organizations of the country in taking up the fight of the gold miner for existence.

The International Gold Conference was a spontaneous effort of the North-West to register its opinion regarding the need of sustaining the gold industry. It followed logically upon the definite position previously taken by the Northwest Mining Association, which has been widely cited by mining men, and approved by the Minister of Mines of British Columbia, the Hon. William Sloan, in his recent report on the conditions of gold production in that Province. It may be noted that the 'internationalism' claimed for the Spokane conference is based primarily upon the fact that the Northwest Mining Association includes British Columbia, and a large delegation of prominent gold producers from that Province was in attendance, including William Fleet Robertson, Provincial Mineralogist; R. F. Green, of the Dominion Parliament; and Ernest Levy, of Rossland. The discussions at the Conference, however, did not trench upon international financial relations. The Canadian delegation appeared to believe that if measures for relief of gold mining were taken by the United States government, the Dominion would follow suit. The significant acts of the International Gold Congress consisted in the adoption of resolutions endorsing the position of the American Gold Conference recently held under the auspices of Emmet D. Boyle, the Governor of Nevada, the Reno resolutions being re-adopted in their entirety, with a further pledge that "the International Gold Conference of the Northwest Mining Association shall work in harmony with the American Gold Conference so that the producers of gold may stand solidly together in seeking the relief necessary to preserve the industry." The American Gold Conference was represented at Spokane by Eugene Davis, Courtenay De Kalb, and H. N. Lawrie, and close working arrangements between the two conferences were definitely arranged.

As an individual expression of the aims and views of the International Gold Conference, additional resolutions, based largely upon a draft prepared by F. A. Ross of Spokane, were adopted as follows:

WHEREAS it is now clearly understood and agreed by the Allied nations that national gold reserves must be augmented without delay if rapidly expanding credits are to be secured; and

WHEREAS, at this time, the production of gold is daily decreasing to an alarming extent because of well-known conditions that render the mining of gold-bearing ores unprofitable; and

WHEREAS there is no way which the mining of gold-bearing ores may be made profitable except by the direct aid and influence of the Government; and

WHEREAS the Government has appealed to the mining industry for practical information and practicable suggestions upon this subject; now, therefore, be it

Resolved, by the International Gold Conference of the

Northwest Mining Association, assembled at Spokane, Washington, September 5 and 6, 1918, and representing Alaska, British Columbia, Washington, Idaho, Montana, and Oregon, that the following topical suggestions for an improvement of the gold situation be offered to the authorities, in the hope and belief that they will prove effective, if properly elaborated and applied, either singly or in combination, as the case may require:

First: That the grant of priority-rights in the purchase and transportation of materials, machinery, and general mining supplies be enforced, and that, as far as possible, such items of expense as taxes and freight-rates be restored to pre-war levels.

Second: That the labor necessary to the operation of mines producing gold-bearing ores be assigned to them.

Third: That main lines of motor-truck roads be built from railroad points into the distributing centres of promising but commercially inaccessible goldfields, for instance, such as those of central Idaho. Also that trails or wagon-roads, connecting with these main roads, be opened to promising camps in cases where the routes thereto lie through Government reserves.

Fourth: That financial aid, or credit, be extended to such individual properties as may be judged by Government specialists to be capable of producing appreciable quantities of gold or other metals essential to the conduct of the War.

Fifth: That a bounty be paid upon every ounce of *new* gold produced by the mines of the nation, the amount of which bounty shall, from time to time, be determined by the proper authorities to be sufficient to encourage the mining of gold-bearing ores by ensuring a reasonable profit therein; the said bounty to be considered a permissible war expedient and expense that in no way affects the international, or standard, value of gold.

Resolved, That this International Conference approves the arguments and general plan outlined in the monograph entitled, 'The Proposed Bounty on Gold,' which is attached hereto and made a part hereof; and that the same is respectfully recommended to the authorities for consideration.

Resolved, That copies of these resolutions be forwarded to the proper authorities at Washington, D. C., and Victoria, B. C.

It will be seen that the scope of these suggestions for relief to the gold-mining industry includes many forms of aid, which are proper in the furtherance of such enterprise, and are in accord with proposals that have been offered in connection with pending legislation, and many plans actually being carried out in regard to the stimulation of the output of manganese, chrome, and other minerals. Such relief, however, would be of small benefit to many of the older productive gold mines, although in some cases it might stimulate important production from districts now dormant. The chief recommendation is that of the payment by the Government of a bounty, adequate to enable the gold mines to operate on a reasonable margin of profit. The Conference also endorsed the pending joint resolution in Congress for continuance of the present exemption from assessment work on mining claims beyond this year, for the period of the War, and added the recommendation that such exemption apply for one year after the year in which the War may terminate. It was further recommended that the Government appoint a practical, successful, gold-mine operator on the industrial commission that is to be sent to Russia, with special reference to the development of the gold resources of Eastern Siberia.

Many notable addresses were delivered, covering every phase of the gold industry and its relations to the national welfare. The bankers' viewpoint was presented by George H. Greenwood of Spokane, carrying with it a recognition of the feasibility of a bounty or royalty. Similar opinions were advanced by Judge George Turner, who presided as chairman of the conference. He insisted that an adequate volume of metallic money was essential to avert a calamity resulting from an era of excessive credit-expansion. His earnest declaration for sound money became the dominant note of the convention, and prevailed in all the resolutions that were adopted. He also showed that a bounty was both feasible and practicable, without disturbing the foundations of finance. W. Dick, president of the Spokane Clearing House Association, also advocated a bounty, and urged governmental action. Maurice D. Leehey and others with Alaskan experience showed that, with small additional outlay in labor and supplies, the Alaskan output of gold might be nearly doubled at once if a bounty were paid sufficient to admit of treating the extensions of deposits on each side of the channels where now only the richer central gravel could be worked at a profit. Valuable statistics covering the output of gold, costs, and the relations of gold to other industries, were given by H. N. Lawrie, chairman of the Oregon Bureau of Mines. He also presented a telegram from the Director of the U. S. Geological Survey, as follows: "No final gold figures for all States available for 1917, and only estimates for 1918 based on mid-year statements. Total decrease this year, ten or eleven million dollars from $84,500,000 in 1917. Increases in Arizona and Montana offset losses in Utah, Idaho, and New Mexico. Decreases, probably four million in Alaska, two and a half to three million in California, two and a half million in Colorado, one million in Nevada, two or three hundred thousand each in South Dakota and Oregon."

A luminous exposition of the national importance of an immediately increased output of gold in providing a protection to our Governmental obligations as the demands of war became more onerous, and as insurance against depreciated currency, was given in an address by Eugene Davis, one of the delegates from the American Gold Conference to the meeting at Spokane.

Coal deposits in the district of Llapo, comprising part of the province of Pallasca in Peru, are described in a report by A. P. Figuerola, and issued by the Peruvian Ministry of Fomento as Bulletin 89 of the Cuerpo de Ingenieras de Minas. They extend over an area of several hundred square miles, at an altitude ranging from 3000 to 7000 ft. above the sea, and are about 30 to 40 miles from the Chimbote-Recuay railroad. It is a dry coal of somewhat unusual character, containing on an average about 20% volatile matter, and 72% fixed carbon, with an ash content of 4 to 9%.

Wages and Salaries

The Editor:

Sir—Mr. Charles M. Schwab has been saying a good deal about the point of view of the workingman. He predicts that economic changes are evolving so rapidly that the proletariat of a few years hence will have unquestioned control of things. By 'proletariat' is meant men who have only their labor to sell, as distinguished from bourgeoisie (detested by the Bolsheviki) who possess a home, or money in the bank, or investments. Schwab's prophecy of the magnitude of the impending change recalls Macaulay's summing up of history as a succession of changes by which a class or group hitherto weak becomes strong and demands rewards equal to its new strength, being resisted by those already entrenched in the enjoyment of privilege and power. The bourgeoisie may prolong their position by adding to their class influential members or cliques of the proletariat. A proletarian who has his wages so raised that he saves money for investing in real estate, Steel stock, or Liberty bonds becomes *ipso facto* a bourgeois. Schwab once drove spikes at a dollar a day for the Edgar Thomson steel works. Today he works equally hard at various big affairs. It is interesting to recall that when Schwab was president of the United States Steel Corporation, he displeased the Wall Street controllers of that company by having "too much imagination" and being "too independent," so that he was finally removed from the position. His Ship Trust was a failure. But big men learn from failures, and he is now directing a successful campaign of building ships to defeat a Hog Trust in Europe.

Karl Marx, the German father of Socialism, deduced from his painstaking study of economics that modern capitalism exploits the laborer by getting possession of the "surplus value" of his services, that is, the amount produced by him over and above the amount of his wages, which are regulated by the "iron law" of competition and tend therefore to a minimum. Many modern agitators reason on this principle. Professor Scott Nearing, now out on bail, complains that "workingmen are only paid $800 or $900 per year, whereas they deserve $1500." No one, he says, has ever figured out what the workingman earns. The employer is not interested in that. For instance, a man who makes a wheel for an automobile or watch, on which perhaps 1% of the labor for the complete product is expended, does not receive 1% of the selling price; he receives a wage that represents the minimum for which another man could be obtained to do the same work. In the gradual adjustment of wages employers have ultimately hurt their own case by offering workmen a temporary bonus to speed up, and then, when a high speed has been proved possible, putting wages back to the old level or very nearly there. When a miner drives a tunnel at a cost of $4 per foot, where the previous cost was $6 per foot, some mining companies begrudge paying extra for the extra skill and application, or perhaps allow the miner only a very small proportion of the saving. Such niggardliness has helped to create the antagonism of labor to capital that has so handicapped employers of late years; it is in avoiding such pinch-penny ways that Schwab succeeds. Like the Irish peasants, many American workmen are today in a favored position but are sulking over old injuries. Scott Nearing can adduce data and juggle statistics to prove that 75% of American workmen are starving, but the evidence of the eye tells any observer that American workmen are a well-fed and healthy-looking class. Of course, there are individual injustices, hardships, and disproportions, but, speaking generally, the man drawing wages has less to worry over than the man on a fixed salary.

Men on a fixed salary are today in a quandary similar to that in which the gold-producers find themselves. Their income has remained stationary while expenses have increased 50%. The gold-producers have held meetings and will probably induce the Government to allow them a bonus. The fixed-salary people cannot hold meetings but have to keep on buying Liberty bonds and the high-priced necessaries of life. As 'Life' remarked recently, "not all the heroes are on the firing-line." The scholarly 'Springfield Republican' professes to see hope for the salaried worker in the drawing of so many men from business and professions into the Army, but as yet no wide-spread movement has acted to raise salaries.

The work that salaried men do is different in character from that of workers who draw wages. They do not drive rivets or make automobiles or run drills. Their work does not show such direct or such practical results. They plan, tabulate, compare; they talk, think, and read; they persuade, initiate, and produce impressions; they analyze, research, and dream. To short-sighted workmen the position of a salaried man seems like a sinecure, for he does not comprehend the strain, constancy, and vigilance under which the latter moves. Commentators like Schwab and Nearing are apt not to see the importance of the results accomplished by the

salaried man. To them the world is one big factory in which everyone should be producing tangible effects. Yet the world would suffer inconceivably if the ranks of silent, thinking, salaried men were much reduced in number or quality. Reasoners like Schwab and Nearing suffer from what Professor R. B. Perry of the department of philosophy at Harvard accused Herbert Spencer of laboring under—'pseudo-simplicity'—the failure to distinguish the simplicity that follows solution from that which precedes it. In general, people are giving too much emphasis to work that shows material results and not enough to invaluable indirection. Such a point of view is narrow and may become sinister. Pseudo-simplicity is a real evil. The man who researches in a laboratory or library is as necessary to the world as the man who drives his thousands of rivets per shift. The latter draws $8 or $10 per day; the former receives $1500 per year, or less than the pay of the riveter.

P. B. McDonald.

Boulder, Colorado, August 25.

The Gold Output: A Suggestion

The Editor:

Sir—There are two standpoints from which to view the much discussed need of an increased gold supply. There is the national or public point of view, looking to the serious situation which undoubtedly confronts the Government in its efforts to hold at par its enormously increased and constantly increasing indebtedness on a comparatively diminishing stock of gold bullion. This point of view appeals to every citizen, no matter where he lives or what his occupaton. There is also the point of view of the mining industry, to which the Government looks for its gold supply, but which to a greater degree than any other industry in the country is caught between the upper and nether millstones of the economic situation growing out of war conditions; for, unlike the product of other industries, the price of gold remains fixed while the cost of production has soared. This point of view appeals to gold-producers and to gold-producing communities, as was brought out at the important conference called by Governor Boyle of Nevada and held at Reno in August. From the standpoint of the public any method that gives promise of increasing the output of gold is worthy of consideration. It was pointed out at the Reno conference that if the Government is to preserve a safe gold basis for its notes and bonds without depleting the reserves of its Allies it would be necessary to increase the annual output of American gold something like fourfold. To help this increase even in a small degree the following suggestion is offered:

It is known that there are large bodies of gold-bearing ore in many of the gold-producing States that will carry approximately one-tenth of an ounce of gold per ton of ore. Even under normal conditions ores of this class offer no commercial attraction. The gross amount of gold thus locked up runs into millions of ounces. The suggestion is that the Federal Government furnish the supplies and the States in which the ores are situated furnish the labor from its prisons, to unlock this now unused and useless supply of needed gold. Many of these orebodies belong to the Government, and others could be commandeered. The cost of the necessary supplies would be less than the premium that the Government could well afford to pay on the gold. There could be no objection to the use of prison labor on this particular work; it would in no wise compete with free labor, because the work can never be done at a living wage; it would be of advantage to all wage-workers, because, other things being equal, the greater the output of gold the greater the purchasing power of a day's wage; and it would help to win the War, as wage-workers in common with all patriotic citizens most earnestly desire. It would be a boon to the convicts, giving them a change from the frightful monotony of their lives and an opportunity to rehabilitate themselves. Their probable sentiments on the subject may be inferred from the remarkable, not to say pathetic, letter recently written by Californian convicts to Governor Stephens, asking as a privilege that they be allowed to build a proposed road to some chrome mines in order that they might help in the War. Men convicted of minor crimes are not thereby convicted of lack of patriotism; and it is a pity that thousands of them, who would gladly offer their lives in France, cannot be accepted as soldiers. The plan suggested would at least offer them an opportunity for useful service. Out of the product of their toil in the mines they should receive a small wage in money and a liberal credit in time-deductions from their sentences. Plans and methods would necessarily be modified by local conditions, and careful investigation by engineers would be required; but the scheme itself, I believe, is sound. It is probable that in the gold-producing States there are more than 5000 prisoners that could be safely employed in the work. In large orebodies an average output of two tons per day to the man could be expected, or a daily product of not less than 1000 ounces of gold; if not great, it would be worth while. In these days, when we are wisely demanding that human parasites shall either 'work or fight', it is well for society to cleanse its house of the unwilling parasites that our uncivilized prison methods have created. The suggestion offered has its ethical as well as its financial side.

F. N. Fletcher.

Carson City, Nevada, September 2.

How to Aid Gold Mining

The Editor:

Sir—In B. L. Thane's article, in your issue of August 3, occurs this sentence, "So far as the United States is concerned, the first and immediate necessity is legislation which will permit the continuation of the present gold-mining industry." In the discussion of the crisis, there seems to be a general hesitation to propose legislation to change the value of gold and a belief that this could only be done in concert with the governments of Britain and France. But, in all probability, it would take many

months, and perhaps years, to reach such an agreement; and as Mr. Thane writes, the problem is one of 'immediate necessity.'' A bounty on new gold would almost certainly affect the value of all gold, no matter what arbitrary price the Government put on an ounce of gold 1000 fine.

Besides, a bounty is likely in some instances to help those producers most who need it least. In other words, the yield per ton of the ore, which is not in the least affected by the War or the Kaiser, becomes a factor in the amount of the bounty. But if legislation could be enacted rebating or refunding to the gold miners the increase in their expenses during the last four years, it would go direct to the root of the trouble, put the man with the rich mine and the poor mine alike on the same footing as they were before the War, and, therefore, be a 'square deal all around.'

The editorial in the 'Engineering and Mining Journal' of August 10, entitled 'The Demand of the Gold Miners' has a glimmering of the light in this direction when it says, ''Thus the Government might enter into an agreement to pay to what are distinctly gold mines a bonus of $10 per oz. upon their production, not to exceed the average annual rate of a series of recent years.'' It can readily be seen that, in the case of some mines, it could happen that this arrangement would frustrate the intention of the Treasury department, which is to stimulate the production of gold and not retard it.

Against this plan it may be argued that there would be a great temptation on the part of the mining companies to 'pad' their costs and that it would take an army of inquisitorial inspectors to see that this was not done. But this would not be as big a task as some might think, for all the legitimate gold-mining companies keep their costs from month to month with great exactitude. On the other hand, in the case of the bounty system, there would be a great temptation on the part of those holding large stocks of old gold to sell to the Government and get the bounty.

THOS. MARSHALL.

Grass Valley, California, August 29.

The Editor:

Sir—In the proper settlement of the matter undertaken by the American Gold Conference a tabulation of conditions seems necessary.

The stimulation of gold mining axiomatically requires reduction of costs, since the very condition of gold as a standard prohibits any increase in its value by Act of Government.

The cost that tends to decrease the production of gold is that of mining, as distinct from metallurgical cost. In other words, the smelters seem to be getting along fairly well without nursing.

The more important items in the cost of mining include labor, freights, explosives, steel, machines and parts, oils for fuel and lubrication, and timber. Of these the first probably cannot be altered. A just increase in all the others is entirely due to Government action under stress of war conditions. The second item—freights—can be entirely eliminated, if deemed wise by the Government, or, at least, to such a point as to establish a proper balance with the increased cost of labor. Action along these lines (combined with the somewhat necessary paternal scrutiny of smelter-rates) would ensure the production of gold as of yore.

A difference of condition is evident between the producing mine and the prospective mine; but amelioration of general costs will serve each alike. The development of prospects always entails a 'gamble': and it is reasonable to suppose that there is less money available for any sort of speculation during time of war. It is axiomatic that, in order to develop mines, prospecting should be fostered; and it may be safe to say that, if the prospector is certain that his property will have an assured value if it develops into a real mine (as a result of the Government protection of gold mining) it is likely that he will rustle for a grubstake as energetically as ever.

F. C. SMITH.

Chloride, Arizona, August 27.

Wood for Mining Purposes

The Editor:

Sir—A matter of great interest to the mining industry is the supply of wood. Realizing such to be the case, Congress passed the following Bill on June 3, 1878:

''Be it enacted etc., That all citizens of the United States and other persons, bona-fide residents of the State of Colorado, or Nevada, or Idaho, or Montana, and all other Mineral Districts of the United States, shall be, and are hereby authorized and permitted to fell and remove, for building, agricultural, mining, or other domestic purposes, any timber or other trees growing or being on the public lands, said lands being mineral, and not subject to entry under existing laws of the United States, except for mineral entry, in either of said States, Territories, or Districts of which such citizens or persons may be at the time bona-fide residents, subject to such rules and regulations as the Secretary of the Interior may prescribe for the protection of the timber and the undergrowth growing upon such lands, and for other purposes. PROVIDED, that the provisions of this Act shall not extend to Railroad Corporations.

Sec. 2. That it shall be the duty of the Register and Receiver of any Local Land Office in whose district any mineral land may be situated to ascertain from time to time whether any timber is being cut or used upon any such lands, except for the purposes authorized by this Act within their respective land districts; and, if so, that they shall immediately notify the Commissioner of the General Land Office of that fact;

And all necessary expenses incurred in making such proper examination shall be paid and allowed such Register and Receiver in making out their next quarterly accounts.

Sec. 3. Any person or persons who shall violate the provisions of this Act, or any rules or regulations in pursuance thereof made by the Secretary of the Interior, shall be deemed guilty of a misdemeanor, and, upon conviction, shall be fined in any sum not exceeding Five Hundred Dollars and to which may be added imprisonment for any term not exceeding six months.''

When this Act became a law, it relieved many who had been trespassers upon the Public Domain from being

prosecuted. The Government realized the importance of fostering the mining industry and lending aid, wherever such was possible, by extending the rights of the individual to all persons, corporations, and associations engaged in mining, to the use of wood off the Public Domain, without restrictions, except as to rules of the Department of the Interior, as mentioned in the Act.

The Commissioner of the General Land Office, has been governed in his granting permits, not by the intent of the Act, but by its specific wording, whereas, he has ruled that a permit is to be denied a corporation organized under one State and operating in another, for the reason, that such a corporation is not a citizen under the wording of the Act. Citizens of any State may enter another and avail themselves of the provisions of the Act, where a corporation is denied this. It is hard to reason why such should be the case, for a corporation is an aggregation of individuals and if they obey the laws of the State in which they are conducting business, they should be considered as being entitled to enjoy all of the rights of an individual; however, the interpretation of the Commissioner is to be observed, rather than invite trouble. He realizes that the law as it now stands should be corrected and has so expressed himself, the remedy lying with Congress.

Senate Bill No. 26, through the joint efforts of some of the members of the mining States of the West, passed the Senate on February 5, last; this aims to amend the Act above mentioned, so that corporations organized anywhere in the United States may avail themselves of the privilege of the Act. This Bill, as it passed the Senate is as follows:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*: That section one of an Act entitled 'An Act authorizing the citizens of Colorado, Nevada, and the Territories to fell and remove timber on the public domain for mining and domestic purposes', approved June third, eighteen hundred and seventy-eight, chapter one hundred and fifty, page eight, volume twenty, United States Statutes at Large, and section eight of an Act entitled 'An Act to repeal timber culture laws, and for other purposes', approved March third, eighten hundred and ninety-one, as amended by an Act, approved March third, eighteen hundred and ninety-one, chapter five hundred and fifty-nine, page one thousand and ninety-three, volume twenty-six, United States Statutes at Large, and the several Acts amendatory thereof, be, and the same are hereby, extended so that it shall be lawful for the Secretary of the Interior to grant permits to corporations incorporated under a Federal Law of the United States or incorporated under the laws of a State or Territory of the United States, other than the State in which the privilege is requested, said permits to confer the same rights and benefits upon such corporations as are conferred by the aforesaid Acts upon corporations incorporated in the State in which the privilege is to be exercised; PROVIDED, that all such corporations shall first have complied with the laws of that State so as to entitle them to do business therein; but nothing herein shall operate to enlarge the rights of any railway company to cut timber on the public domain."

There are at this time, many corporations, without any knowledge that they are trespassers upon the Public Domain, who are using the wood from off such domain for mining purposes that may be prosecuted therefor. They are ignorant of the fact that they are violating the law, and may only discover this when an action has been begun against them. This condition is a manifest injustice and it should be remedied at once.. The purpose of this communication to you is to arouse interest and bring this serious state of affairs to the attention of those who may be affected. The officers of the Government are interested in having nothing interfere with the going mining concerns of the country, or to cause any contraction in the supply of metals. This matter has come before, not only the General Land Commissioner, but many of the heads of the Government, and they are all a unit in declaring that the defect in the law as it passed originally should be remedied. The Bill, after its passage through the Senate, was referred by the House to the Committee on Public Lands. It is now in that Committee. It would appear that the time that has since elapsed should have been sufficient for the Committee to have acted upon it; however, I am advised today that such has not been the case, evidently, it must be that other matters have been given preference of action.

There are many corporations operating in the West that, in order to continue operations, may find it necessary to ship into their districts, at much added expense and inconvenience, either coal or oil, for fuel. In either case, they immediately add to the burden imposed upon the coal mines and oil-wells to meet the demands from other sources, involving war needs, thus bringing about complications and troubles that should not exist, and would not, if the Bill now in the House becomes law at an early date. Undoubtedly there are some corporations now calling for supplies of coal and oil, for fuel, that would be able to use near-by wood were the Bill passed.

It may be well to mention that in the remote mining regions of the West much depends upon what conditions are imposed upon the securing of local fuel, and, where it is incumbent upon corporations to secure fuel from long distances, the consideration that might otherwise be given to the development of a mining prospect will be abandoned, thus retarding the development of our mineral resources, for usually companies that have organized outside the State are those most capable of large-scale operations. I might also refer to the operation in the areas that are well supplied with timber, not alone in the Western States, but, more particularly in Alaska. What a spectacle is presented of wasted energy where corporations formed outside the State are obliged to haul oil several hundred miles by rail, thence by wagon, for 40 or 50 miles, perhaps again to be carried to the mountain-tops by tram to the mines, to be consumed, in a locality where timber abounds. Is it not a rediculous acrobatic feat that they are called upon to perform by virtue of defective laws? How is it possible, under such conditions, to practice the economy necessary to make our mines remunerative?

The operators of mines wish to have this condition corrected, the citizens of the various mining States are vitally interested that such should be done, to increase

interest in their mineral deposits by inviting outside corporations to join in the development of their mines: the wonder is that a matter of such vital concern should remain so long without having been corrected, and without the attention from Congress that it deserves. The Government itself is concerned, and well it should be, for such circumstances as force corporations to abandon, against their will, any development work that has for its purpose the production of metals is against the national interest. We need to have this Bill become a law just as soon as possible. Our Congressmen should be petitioned to get this measure on the statute-book quickly. The purpose of this letter is to make the mining fraternity aware of the anomaly, so that they may ask their Representative to give this Bill his special attention. The several departments of the Government interested in the production of minerals should also interest themselves in promoting the early passage of the Bill.

JOHN T. REID.

Lovelock, Nevada, August 26.

Copper Phosphate in Cyanidation

The Editor:

Sir—At a time like the present, when we are straining to increase gold production, some observations I have made while employed, either as assayer or in charge of cyanide plants, on gold-silver properties may point out a possible trouble in other plants and work for good to the industry.

The mines referred to are the Relief mine, 25 miles north-east of Phoenix, the Empire mine, about six miles south of Marysville, Montana, and the Easton and Pacific group, six miles north-east of Virginia City, also in Montana. On the first two properties the owners were cyaniding tailing, the third one was crushing the ore to about 24-mesh, concentrating on vanners and cyaniding the tailing, leaching the sand and agitating the slime, then settling and decanting.

In all three plants the zinc-boxes at times caused much trouble. At such times the presence of copper was emphasized, selective precipitation was marked, also accumulations of a granular precipitate that settled with the bullion mud and even formed large clods of the material in the lower compartments of the zinc-boxes. During one such period, at the Easton, when this trouble was at its worst, I went through the mine and investigated the appearance of the ore-faces trying to find an explanation of the difficulty. I noticed the particular greenish cast on certain streaks that appeared to be copper silicate, but upon testing the same they were found to be a copper phosphate. Since then, by working on the theory that phosphate was the evil, I have been able to recover the gold from rich sump-solutions that the operators were unable to treat.

My conclusion is that a reasonably strong cyanide solution, say 1½ lb. per ton of solution, will attract the copper phosphate, the copper going into solution as a double cyanide and the phosphate joining hands with the alkali. When the solution from the treatment vats is passed to the zinc-boxes, the sodium phosphate is split up by the nascent hydrogen formed at the time of precipitation of the metal on the zinc, with the formation of phosphene (PH_3). The presence of phosphene in the solution tends immediately to react on the unprecipitated metal in the solution, causing selective precipitation, the metals plating out approximately in the following order: gold, silver, copper, bismuth, antimony, arsenic; this condition going to the extent of even causing the precipitation of the metals in an amorphous condition, in which state they totally evade precipitation on the zinc and pass to the sump.

The few experimental tests made on these solutions using zinc-dust instead of shaving seem to indicate that the dust was the most efficient precipitant of these poisoned solutions. I suggested the use of lead acetate at the plant and was satisfied of possible improvement in recovery and increased ease of operation. However, the general superintendent could not see it, so the subject was dropped.

In conclusion, permit the suggestion that the use of lead acetate in leaching-vats together with a small amount of ammonium chloride or carbonate might keep the phosphate in leaching-vats where it belongs, thus possibly increasing extraction, eliminating trouble in the precipitation room, the melting-room, and at headquarters.

GEORGE D. DIEHL.

Phoenix, Arizona, August 16.

P. S. There was considerable copper phosphate in the ore from each of the mines mentioned.

EXPERIMENTS with the addition of limestone to a number of soils, are given by N. Kopeloff, in 'Soil Science.' Limestone ground sufficiently fine to pass a 200-mesh sieve was as effective as burnt lime. Increase in fineness of division of limestone from 20 to 40, 60 to 80, 100 to 200, and to finer than 200-mesh, caused a proportional increase in the yield and in the total nitrogen content of clover on several soils, and a corresponding decrease in the lime requirement. Limestone finer than 60-mesh required about 3 weeks, while 20-mesh limestone required more than 7 weeks to effect neutralization. An increase in the fineness of division of pulverized limestone caused an increase in the activity of the bacteriological processes of ammonification, nitrification, and nitrogen fixation. The increase in bacteriological activities with an increase in fineness of division of limestone may be correlated directly with the chemical factors involved, such as the rate of neutralization of acidity, and also the crop-yield. On light sandy soils, which leach readily, limestone ground to pass 60 to 80-mesh was more effective than finer material. The nitrogen content of the plant was, however, higher where finer limestone was used. An increase in the fineness of division of pulverized limestone was accompanied by a reduction in the lime requirement. An analysis of the drainage waters indicated that there was a decreased loss of NH_3 and NO_3 but an increased loss of calcium.

The Mining Engineer as Administrator

By F. W. HIRST, Editor of 'Common Sense', London

One of the outstanding personalities in the world today is neither king nor general nor professional statesman, but a mining engineer—Mr. Herbert C. Hoover, who is grappling with the giant's task of increasing and putting to their best use the food resources of the United States. In every country in the world, belligerent or neutral, the problem of food supply is one of increasing urgency, but nowhere is the task so complex or on so large a scale as in America. Since Joseph was commissioned to provide against impending famine in Egypt, no government executive has undertaken so heavy a responsibility of this kind as now lies upon the shoulders of Mr. Hoover. President Wilson could not possibly have made a better choice. In the whole of the War no enterprise, military or civilian, has been carried out with more efficiency than the work of the American Relief Commission, of which Mr. Hoover was the head. It was, therefore, no untried man whom the President appointed to be Food Administrator of the United States, but one who had already proved his skill and resourcefulness in dealing with a kindred problem. Mr. Hoover is still in his prime, and his autobiography is unwritten. But, in a volume published in America a few years ago, he has indirectly gone far to explain how it comes about that, in a time of crisis, a member of his own profession is likely to come to the front. This book incorporates a series of lectures and is entitled 'Principles of Mining.'

Most of it, of course, is purely technical, but in the final chapter on 'The Character, Training, and Obligations of the Mining Engineering Profession,' Mr. Hoover begins by pointing out that the distinctive characteristic of mining engineering over other professions akin to it is the vast preponderance of the commercial over the technical in its daily work. The services it renders are nowadays not so much advisory as executive. The modern mining engineer spends the greater part of his time not in concocting reports and preparing blue-prints, but in devising methods of finance and in constructing and managing works. At first he used to make his way up from the ranks of the workmen. Later, he passed through an apprenticeship. Today, the occupation of mining engineer has reached the dignity of a profession, and the heads of it must possess not only a wide knowledge of civil, mechanical, electrical, and chemical engineering, together with geology, but an acquaintance with economics and the humanities, and also the engineering sense, executive ability, business experience, and financial insight. In no other branch of engineering is this combination of qualities required to anything like so great an extent.

In the first place, says Mr. Hoover, the problem of determining the commercial value of the projects undertaken bulks more largely in the occupation of the mining engineer. Mines are operated only to secure an immediate profit. They often change owners several times during their career, so that they have to survive a periodic re-valuation. In works of public utility, on the other hand, the profit-and-loss phase hardly enters at all. The life of a mine is short. Its works are of no value when the mine itself is exhausted. Other engineers must build as solidly as they can, but the mining engineer has to consider whether a cheaper device will answer the purpose.

The next point suggests a close parallel with the task Mr. Hoover has now in hand. Other engineers, he reminds us, can better marshal in advance the factors with which they have to deal. But the mining engineer depends on many elements which must remain unknown. He has to deal with conditions buried in the earth. Especially in the case of metal mines he cannot know, when his works are initiated, what the size, mineralization, or surroundings of the orebodies will be. He must plunge into them and learn—and repent. He is confronted with the necessity of daily re-planning—again, surely, a reminder of the worries of a food controller. "Weary with disappointment in his wisest conception, many a mining engineer looks jealously upon his happier engineering cousin, who, when he designs a bridge, can know its size, its strains, and its cost; and can wash his hands of it finally when the contractor steps in to its construction. And above all, it is no concern of his whether it will pay."

Mr. Hoover rightly dwells on the fact that the mining engineer is called upon to direct and control large bodies of workers. Metal mines are usually situated at a distance from centres of comfort and culture—indeed, at the very outposts of civilization. In this matter Mr. Hoover can speak from his own experience, for he has directed mining enterprises all over the world—from Mexico to China. The mining engineer, as he points out, exercises practically a chieftainship over the mining community. He has to be a man of decision.

Those who know Mr. Hoover will recognize in the conclusion a favorite topic of his conversation. "The engineering profession generally," he writes, "rises yearly in dignity and importance as the rest of the world learns more of where the real brains of industrial progress are. The time will come when people will ask, not who paid for a thing, but who built it. To the engineer falls the work of creating from the dry bones of scientific fact the living body of industry. It is he whose intellect and direction bring to the world the comforts and necessities of daily use. Unlike the doctor, his is not the constant struggle to save the weak. Unlike the soldier, destruction is not his prime function. Unlike the lawyer, quarrels are not his daily bread. Engineering is the profession of creation and of construction, of stimulation of human effort and accomplishment."

CEMENT PRICES have been fixed by the War Industries Board, for Government use. These range from $1.57 to $1.97 per barrel, 3 cents below present prices, and are f.o.b. cars at 29 points in the country. The prices are for the remainder of 1918.

Conveyors

By ROBERT S. LEWIS

The belt-conveyor is an exceedingly simple and efficient carrier of loose material that is to be handled in a continuous stream and in large quantities. Grain, ore, coke, coal, and gravel are economically transported in this way. However, it is not necessary that the material be in loose form; filled sacks, loaded boxes, packages of various sizes, and even bundles of magazines, as practised by some of the largest publishing houses in the country, are handled by belt-conveyors. Within certain limits belt-conveyors can be used for elevating material. An interesting illustration of this use is to be seen in the crushing department of the new leaching-plant of the Utah Copper Co. The conveyors here are installed between the gyratory crusher, two sets of rolls in series, and the storage-bin, thus eliminating the troublesome bucket-elevator. Though belt-conveyors can be loaded or unloaded at any point along their length the most economical operation requires that they should be loaded at one end and discharged at the other. When properly installed and cared for they are reliable, and their flexibility, as well as their large capacity, makes them a satisfactory means of transporting material. Where a steady and continuous delivery of material is desired the belt-conveyor is unequaled by any other device. It is not an efficient machine for intermittent work, nor is it to be recommended where the discharge must occur at a number of points, because heavy wear is entailed by several trippers. The belt should always be loaded to its capacity.

DETAIL OF BELT. A rubber-covered belt is generally used. Steel bands, woven cotton, and stitched canvas, have been tried but have not proved satisfactory for handling wet material. Belt-conveyors are sooner or later subjected to the action of moisture, in mining work, and only rubber-covered belts will resist moisture successfully. Balata, a vegetal gum from Venezuela and the Dutch East Indies, is similar to rubber, but has greater tensile strength and deteriorates but slowly. However, its higher cost and the careful manner in which it must be worked, have operated against its extensive use.

Belts are made by covering a layer of duck with rubber, or 'friction,' as it is called. The duck is then cut to the desired width, the requisite number of plies are placed together and the rubber cover is laid on. The finished belt is then made by running the whole through the vulcanizing-press, the heat and pressure making a compact and solid belt. The tensile strength of a belt depends upon the weight of the duck used in its manufacture. Duck comes in weights ranging from 28 to 36 oz., the weight applying to a piece 42 in. wide by 36 in. long. A first-class belt should contain nothing lighter than 30-oz. duck. The life of a belt depends upon the protection offered by the rubber cover in keeping out the moisture, which, having once entered the canvas, causes the plies to separate and the cover to loosen or blister, and to lessen the strength of the 'friction' to hold the plies together, especially when passing around the pulleys.

It is not a difficult matter to keep an accurate account of the performance of any belt-conveyor nor to make a few informing tests on a new belt, yet it is not often that an authentic record of performance can be found. The data obtained are generally carried in the head of the foreman or superintendent of the plant, and are often unreliable because of personal prejudice in favor of or against the goods of a certain manufacturer. A good form of record, proposed by the B. F. Goodrich Co., is shown below.

Company	Place where used	
Plant	Conveyor	
Width of belt	Material	Sketch of conveyor
Length of belt	Maximum size	
Number of plies	Minimum size	
Top cover	Wet or dry	
Back cover	Average hours per day.....	
Furnished by	Speed	
Order number	Drive	
Manufacturer	Load applied at	
Brand	Number of loading points..	
Price per foot	Length centre to centre....	
Date received	Difference in elevation.....	
Date put on	Angle of incline	
Date taken off	Trippers	
Length of service		
Cost of belt		
Repairs: Labor		
Material ...		
Total cost		
Total tons handled...		
Cost per ton		

The following tests, recommended by the Robins Conveying Belt Co., can be carried out by means of a spring-balance, small clamps, and a cutting-die for the rubber cover.

1. Binding strength of the 'friction.' Cut from the end of the belt a strip exactly one inch wide. Commence at the back or bottom of the strip and about three inches from one end, after marking on the strip, with ink, distances one inch apart; cut and pry loose the outer ply for about one inch. Hook the spring-balance into the ply and pull with the balance until a weight equal to the specified strength of friction is indicated. With this tension kept uniform, the rate of separation of the plies should not exceed one inch per minute.

2. The strength of adhesion of the rubber cover is found in the same way.

3. Strength and elasticity of the rubber cover. For this test remove a piece of the cover and cut it, by means of the die, the size and shape shown in Fig. 1. Gauge

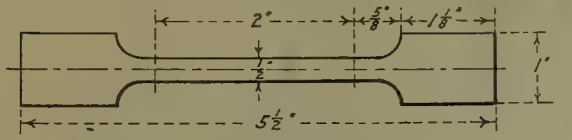


FIG. 1. CUTTING DIE

the thickness with a micrometer, allowing for projections caused by the impressions of the duck on the under side. Mark with ink on the strip a distance of two inches. Attach clamps and apply a steady pull until the two marks have been stretched apart a specified distance, say from four to six inches. Relax the tension, and immediately measure the distance between the marks. The increase over two inches is the 'immediate set,' which should not exceed the specified amount. The tensile strength of the cover is next obtained by stretching until the piece breaks. If P is the pull in pounds shown on the balance at the time of breaking, and T is the thickness in inches of the cover, the tensile strength per square inch, the strip being $\frac{1}{2}$ in. wide, is

$$S = \frac{2P}{T}$$

4. Strength of duck. This can be determined only in a testing-machine. Manufacturers will give this value upon request.

The exact value of the data obtained changes with the kind and make of belt tested, and is a matter of specification with the manufacturer. Records of tests compared with the performance of belts will indicate how a belt can be judged before it is used. In regard to the first test, it may be said that poor belts will begin to strip under a pull of 7 or 8 pounds per square inch. A well-made belt may show a resistance as high as 26 lb.; a good average is 16. A belt should be made for the particular work it is to do; consequently one set of specifications will not serve for all belts. The tests will show whether a belt comes up to the specifications.

Stepped belts have a greater number of plies at the edge than at the middle, and the rubber cover is correspondingly thicker at the centre of the belt. This construction makes a belt that is very resistant to abrasion and one that does not bend greatly between the troughing idlers. Roughly speaking, belts with a $\frac{1}{8}$-in. rubber cover at the centre have plies at this point one less in number than at the edges. Belts with a $\frac{3}{16}$-in. cover at the centre have a difference of two in the number of the plies between the centre and the edges. Where the difference in plies is two, the belt may be considered as the equivalent of a straight belt having one less than the maximum number of plies at the edges. Thus a 40-in. stepped-belt of 9 and 11 plies would be equivalent to a straight belt of 10 plies.

The following table gives the weight in pounds per foot of straight belts with $\frac{1}{8}$-in. cover, as prepared by the Robins Conveying Belt Company.

Width, inches	Number of plies					
	3	4	5	6	7	8
12	2.4	2.6	2.8	..	..	..
14	2.7	3.0	3.3	3.6	..	..
16	3.0	3.4	3.8	4.1	..	..
18	3.4	3.8	4.2	4.7	5.1	..
20	3.7	4.2	4.7	5.2	5.6	6.1
22	..	4.7	5.2	5.7	6.2	6.7
24	..	5.1	5.7	6.2	6.8	7.4
26	..	5.5	6.1	6.7	7.3	8.0
28	..	..	6.6	7.3	7.9	8.6
30	..	..	7.1	7.8	8.5	9.2
32	..	..	7.6	8.3	9.1	9.8
34	..	..	8.0	8.8	9.6	10.4
36	..	..	8.5	9.3	10.2	11.0
38	..	..	9.0	9.8	10.7	11.7
40	..	..	9.4	10.4	11.3	12.3
42	..	..	9.9	10.9	11.9	12.9
44	..	..	10.4	11.4	12.4	13.5
46	..	..	10.8	11.9	13.0	14.1
48	..	..	11.3	12.4	13.6	14.7

WIDTH OF BELT. Three factors must be considered in determining the width of a belt: the size of the largest piece carried, the speed of the belt, and its capacity. Where large lumps are to be carried, their size, rather than the number of tons per hour to be transported, fixes the width of the belt. Obviously, the capacity of a belt varies with the speed. The relation between these factors is shown in the following equation:

$$\frac{c_1}{c_2} = \frac{v_1 (w_1)^2}{v_2 (w_2)^2}$$

where c = capacity in tons per hour, v = velocity in feet per minute, and w = width of belt in inches. Thus, for two belts run at the same speed their capacities vary as the square of their widths.

PULLEYS AND DRIVES. All pulleys should be at least two inches wider than the belt. Owing to their slow speed and the heavy stresses to which they are subjected, pulleys should be made extra heavy and in a single piece. Sectionalized pulleys are a never-failing source of trouble. For heavy drives lagged pulleys are best. Rubber lagging increases the tractive force of pulleys nearly 40%, and is generally used unless the material handled is very wet, in which case wood lagging is to be preferred. Heavy keys and two set-screws, one over the key and one on the shaft, ensure a solid fastening to the driving shaft.

As mentioned above, the bending-stresses in a belt, as it passes around a pulley, shorten its life, just as bending around the head-sheave affects the life of a hoisting-rope; consequently pulleys of small diameter should be

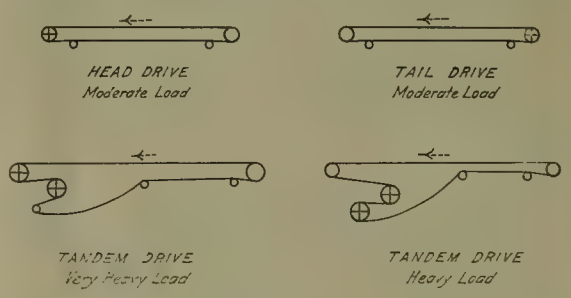


FIG. 2. TYPES OF CONVEYOR DRIVES

avoided. A good rule is to have the diameter of the pulleys not less than 5 or 6 in. for each ply of belt. A three-ply belt would then have a pulley of from 15 to 18 in.

diameter. Some engineers recommend a diameter of 8 in. per ply.

The conveyor-drive is most commonly placed at the head or discharge end, though, if necessary, the drive may be placed at the tail end or at any intermediate point. Four types of drive are in general use; single bare pulley, single lagged pulley, double bare pulleys, and double lagged pulleys. Some arrangements of pulleys are shown in the sketches on the preceding page.

CAPACITIES, PLIES, AND HORSE-POWER. Charts No. 1, 2, and 3 have been devised by the Robins Conveying Belt Co. Chart No. 1 gives the capacities and recommended belt-speeds for various widths of belt. Enter the chart at the left margin with the load in tons per hour, and pass horizontally to intersect the diagonal for the weight of material per cubic foot; then go vertically down the diagonal for the width of belt. A horizontal line from this point cuts the proper speed at the right margin. The width of the belt, and the speed, can be changed until a suitable combination is found. In case large lumps are to be handled, their size will govern the width of belt. The solution shown on the chart is for undersized material containing 8-in lumps. The belt-width is 24 in., the speed is 240 ft. per minute, and the capacity is 225 tons per hour of material weighing 100 lb. per cubic foot. If the lumps were 14 in. a 30-in. conveyor, operating at a speed of 160 ft. per min., would be indicated. The diagonals for the width of belt are terminated at the maximum advisable speeds, and caution should be used in exceeding these figures. Most belts are run at speeds between 250 and 400 ft. per min. Sorting-belts are run at much lower speeds, from 25 to 50 ft. per minute.

Chart No. 2 gives the horse-power for belt-conveyors. The width of the belt and the speed having been determined, the chart is entered at the upper left margin with the weight of the material handled in pounds per cubic foot. Pass vertically down to cut the diagonal for the width of belt, then horizontally to the speed in feet per minute; next, go vertically down to cut the diagonal for the length of the conveyor (centre to centre); lastly, passing horizontally to the left margin to obtain the horse-power required for the fully-loaded belt. The power required for a lightly-loaded belt will be less than this, but a motor should be installed to handle a belt fully loaded. For inclined conveyors add 1/1000 of a horse-power for each foot ton of lift per hour. The solution given is for a fully-loaded level conveyor, 36 in. wide, 300 ft. long, and carrying material weighing 50 lb. per cubic foot, at a speed of 250 ft. per minute; 18 horse-power is required. This power is for the conveyor alone. It should be remembered that for a large driving-pulley, slow belt-speed, and high motor-speed, the loss in gear-reduction may reach 40%. It rarely falls below 15%. The conveyor itself will show a 30 to 50% friction loss on a bare pulley. The power required for operating an empty conveyor will range from about 35% of full-load power for belts from 36 to 48 in. wide to 45% for belts from 12 to 24 in. wide. These figures are based on the assumption that the ore weighs from 100 to 125 lb. per cubic foot. Trippers will require, roughly, about 1 hp. for belts up to 24 in. wide,

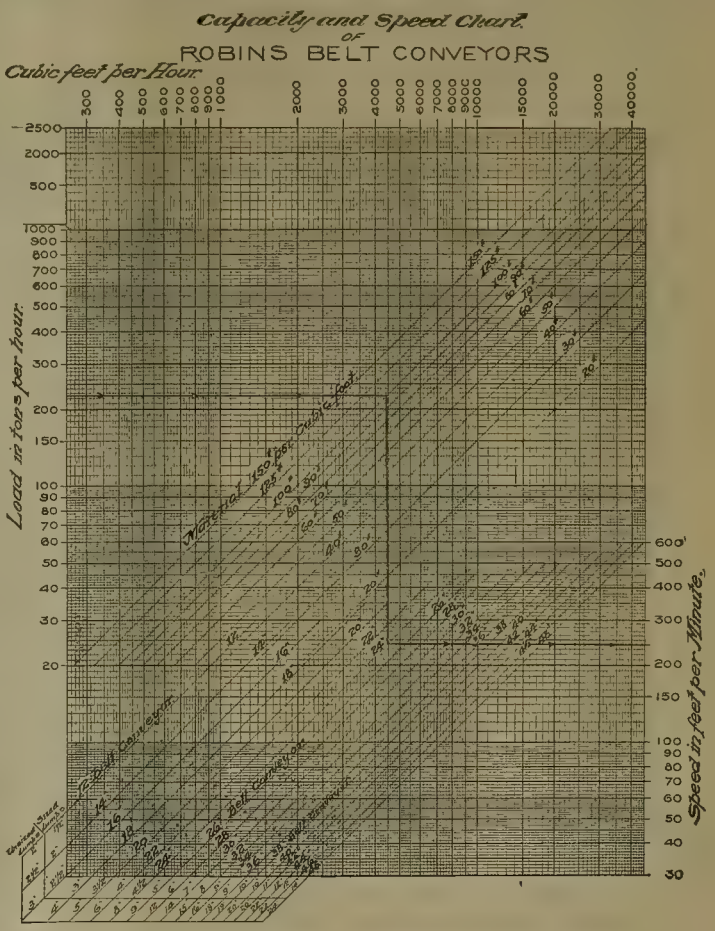


CHART No. 1. CAPACITY AND SPEED OF BELT-CONVEYORS

and 2 hp. for wider belts, when the conveyors are operated at moderate speeds, say, 300 ft. per minute. R. L. Streeter, in the 'Engineering Magazine' for January 1916, gives the following empirical rule for the power required for trippers. $HP = \frac{W-10}{8}$, where HP is the horse-power required and W is the width of the conveyor-belt in inches. The results obtained from this formula are somewhat high for low speeds, but are quite satisfactory for speeds as high as 600 ft. per minute.

To find the number of plies when the horse-power, speed, width of belt, and type of drive are known, use Chart No. 3. Enter the chart at the left margin with the horse-power required, and pass horizontally to cut

the diagonal for the speed of belt, then down vertically to the type of drive used; next pass horizontally to the diagonal giving the width of belt. The number of plies required is at the bottom of the chart vertically below this point. The chart gives the solution for 15 hp., a 24-in. belt, and a speed of 250 ft. per minute; 6.8 plies are indicated as required, and this means a 7-ply straight belt. The plies thus found ensure a proper strength of belt for the pull it is to stand. A rough rule is that the working-tension should not exceed 20 lb. per inch of width per ply.

The following formulas are given by the B. F. Goodrich Company:

Let p = correct number of plies.

k = constant depending upon type of drive.

g = weight of material in pounds per cubic foot.

W = belt width in inches.

L = total length of belt in feet (roughly twice the distance between centres).

H = difference in elevation between head and tail pulleys in feet.

U = capacity in tons per hour.

S = speed in feet per minute.

HP = horse-power developed in driving the belt.

L' = length of conveyor in feet, or $\frac{1}{2}L$.

T = total tension in belt in pounds.

C = constant depending upon type of drive.

$$(1) \quad p = k\,g\,W\,(L + 10H)$$

$$(2) \quad U = \frac{0.08\,W^2\,S\,g}{5000}$$

$$(3) \quad T = \frac{C \times HP \times 100}{S}$$

$$(4) \quad HP = \left(\frac{0.02\,L'}{100} + \frac{0.01\,H}{10}\right) U$$

$$(5) \quad p = \frac{T}{24\,W}$$

Type of drive	Value of k	Value of C
Simple bare pulley	1/250,000	600
Simple lagged pulley	1/300,000	500
Tandem bare pulley	1/375,000	400
Tandem lagged pulley	1/445,000	330

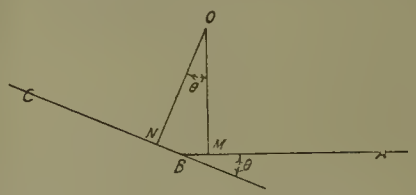
The charts and formulas give results that represent fair averages, and ensure the proper number of plies to withstand the pull upon the belt. If the number of plies indicated is only one or two, it is obvious that, though sufficiently strong for any tensile stresses, the belt would not have the necessary stiffness between the troughing idlers. The smallest number of plies that a belt of a given width should have are given below.

Width, inches	Plies	Width, inches	Plies
12–16	3	32–36	6
18–24	4	36–48	7
26–30	5		

A belt that is too stiff will not conform to the shape of the idlers, and will wear out rapidly at the edges. A belt having an insufficient number of plies will be so flexible that it will flatten between the idlers, and the banding may crease the belt down the centre and start the separation of the plies along this line. The weight of a properly designed belt should cause it to conform to the shape of the idlers.

Inclined Conveyors. The charts and formulas are suitable for inclined conveyors as well as for those that are horizontal. In general, fine material, or lumps mixed with fine, can be handled on steeper angles than closely sized material. A uniformly loaded conveyor can be operated at a steeper angle than one which carries an intermittent load. Fine material has been successfully carried at an angle of 22° from the horizontal, but the limiting angle for ore should not be greater than 18°. This will effectually prevent any material from running back on the belt.

It may be necessary sometimes to place a vertical curve in a conveyor. This saves installing an additional conveyor, though, for other reasons, it may not be the most desirable solution of the problem. Care must then be taken that the belt does not rise above the idlers on the curve. This condition is most likely to occur when the part of the conveyor below the curve is loaded and that on and above the curve is empty. This danger will be avoided if conveyors, not over 30 in. wide, are installed with a curve of 250 ft. radius, and wider conveyors with a curve of 300 ft. radius. In order to determine the shortest possible radius that such a curve may have, the weights per lineal foot of the empty and



loaded conveyor must be known. The curve then can be calculated from the equation of the catenary. To find the ends of a curve when the radius is known, let AB and CB be the two directions of the conveyor between which the curve is to be installed, and let Θ be the angle between these lines. If R is the radius of the curve in feet, distance BM = distance $BN = R \tan \frac{1}{2}\Theta$. Erect perpendiculars at N and M, and their intersection gives the point O, or the centre from which the curve can be drawn.

Idlers. The spacing of troughing-idlers should bear a relation to the weight per cubic foot of the material carried. The heavier the material, the closer should be the spacing of the idlers. At the loading-points it is advisable to have the idlers placed at one-half of the usual spacing. The spacing to be recommended for troughing-idlers to convey material weighing 125 lb. per cu. ft. is given below:

Width, inches	Spacing, feet	Width, inches	Spacing, feet
12	4.5	28	3.5
14	4.5	30	3.0
16	4.5	32	3.0
18	4.0	34	3.0
20	4.0	36	3.0
22	4.0	40	3.0
24	4.0	44	3.0
26	3.5	48	3.0

Return-idlers are commonly spaced 10 to 12 ft. apart. Idlers are generally cast-iron pulleys mounted on hollow

shafts made of cold-drawn seamless tubing. Grease-cups on the ends of the shafts serve to force the grease through holes in the hubs of the pulleys and thus form protective rings, which effectually exclude the dirt. Steel pulleys having ball or roller bearings and using oil lubrication are economical where costs of power are high.

INSTALLATION AND USE. If the material is fed upon the belt in the direction of its travel and at the same speed, the wear on the rubber cover will be considerably reduced. This can be accomplished by suitably arranged chutes. If the material contain sharp lumps a grizzley or screen can be placed in the bottom of a chute close to the end. The fine material will then form a protective layer on which the lumps fall. It is not a good plan to put a chute where it supplies feed to a belt either directly over an idler or to one side of the centre of the belt. In the latter case, the belt will not run true on the idlers, but will work to one side. Chute-boards and pieces of belt, used for guides, should not touch the conveyor. Guide-idlers cause rapid wear of the edges of the belt, and are not necessary if the troughing-idlers are placed at right angles to the line of travel of the belt and are carefully maintained in this position. The belt will then show no tendency to travel to one side. If the belt runs to one side, it is the third idler back that needs to be straightened, and not the one at which the side-travel appears. Idlers should be kept well greased. Whenever they run hard, or stick, both the power required by the conveyor and the wear of the belt are increased. The return part of the conveyor is covered to prevent pieces of material falling from above and getting between the belt and the return-idlers, which would injure the belt. It is advisable to examine the belt about once each week for cuts in the cover. If these holes are cleaned out with gasoline, thoroughly dried, and then plugged with good rubber cement, the life of the belt will be materially lengthened. Moisture that once gets under the rubber cover causes the plies to separate and the duck to rot. Unless all brushes and scrapers for keeping the return part of the belt clean are maintained in good condition they are of little service.

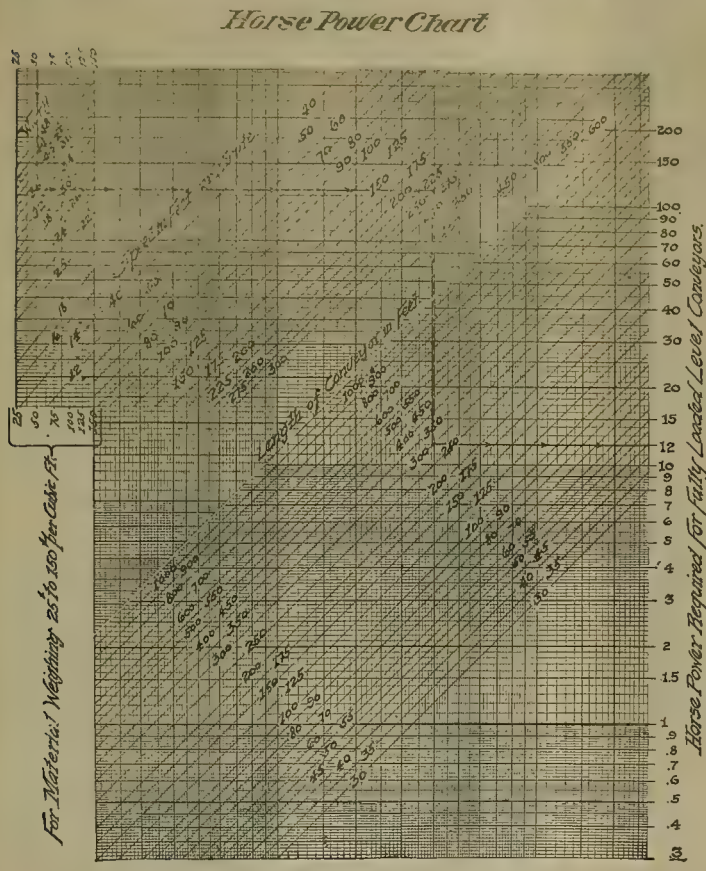

Horse Power Chart
For Materials Weighting 25 to 150 per Cubic Ft.
Length of Conveyor in Feet
Horse Power Required for Fully Loaded Level Conveyors

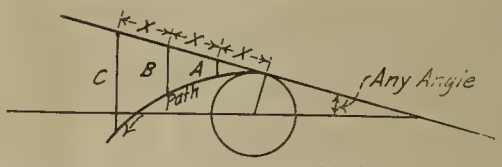
CHART NO. 2. HORSE-POWER OF BELT-CONVEYORS

Loaded incline-belts will run backward and pile up their loads at the bottom whenever the driving-power fails, unless a check be provided. Some excellent safety-devices are on the market. A simple one consists of a large ratchet-and-pawl placed at the head of the conveyor. The pawl catches on a tooth of the ratchet and stops the conveyor as soon as the belt starts to run backward. To prevent undue strain upon it, a belt should be run just tight enough to prevent slipping, and no tighter. Care must be exercised to adjust the take-ups at the tail-pulley equally, or the belt will not run straight. Like the independent adjustment on rolls, it is not easy to move the two sides exactly the same distance.

To splice belts, cut both ends square and bring them together by means of belt-clamps. Mark the belt lightly with the points of the metallic belt-lacing or hooks, but do not drive the lacing in until the holes have been punched with an awl. Then drive in the hooks, supporting the belt on a block of soft wood. Turn the belt over, remove the block and clinch the lacing toward the joint. Before splicing, it is a good plan to coat the ends of the belt with rubber cement to keep out moisture. The following sizes of Bristol belt-lacing or their equivalent are recommended:

Ply of belt	Size of lacing, No.	Ply of belt	Size of lacing, No.
3	113	7 and 8	117
4 and 5	114	9, 10, and 11	119
6	115		

The trajectory of the material delivered by a conveyor is of value in designing discharge-hoppers or chutes.



The distance X in inches $= \frac{\text{speed in feet per minute}}{100}$

The different vertical distances from the projected line of travel of the belt to points on the path of the falling

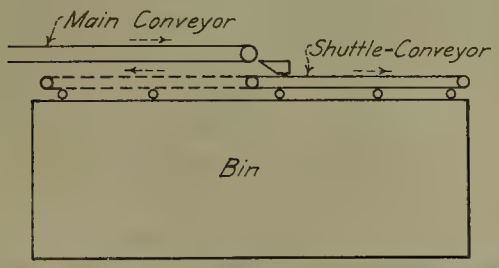
particles is shown in the accompanying table, prepared by the Jeffrey Conveyor Company:

Distance	Inches	Distance	Inches
A	0.4284	H	30.8736
B	1.9296	I	39.0744
C	4.3416	J	48.2450
D	7.7184	K	58.3704
E	12.0600	L	69.4556
F	17.3664	M	81.5256
G	23.6376	N	94.5504

The values given in the table will not hold good for material that sticks to the belt or is so light that it is easily deflected by the resistance of the air.

In selecting a conveyor-belt, the tonnage carried and the length and lift of the conveyor must be considered in connection with the number of plies, width, and speed of the belt. A belt should be designed to run fully loaded to ensure the greatest economy of operation. It is evident that the same belt will not be suitable for various lengths of conveyors. One company installed an additional conveyor half the length of the one already in operation, and was surprised not to get equal wear from the belt. The more frequent bending over the pulleys, and the greater abrasion from loading, since each part of the belt came under the chute twice as often as with the long belt, caused rapid wear. Since the operating tension in the short belt was less than for the long belt a smaller number of plies, with a heavier rubber cover, was indicated for this conveyor.

Automatic trippers, though mechanically efficient, are not the most desirable means of discharging a conveyor, as they entail heavy wear on the belt. The comparatively small pulleys of the trippers cause additional bending-stresses and, because of imperfect cleaning, the material that sticks to the belt is pressed into the rubber cover by the second pulley. A shuttle-belt discharge is not open to these objections. The short belt, a little longer than one-half that of the bin, runs on a track and is moved back and forth, either mechanically or by hand. The main conveyor, extending to the middle of the bin, discharges upon the shuttle-conveyor, which can be run



in either direction, thus being made to deposit its load at any desired place.

Repair, renewal, and lubrication-charges on belt-conveyors are not difficult to determine, but depreciation is a complicated problem. Reginal Trautschold, in the 'Engineering Magazine,' August 1916, states, in part, that "depreciation is due not only to wear but to constant and quite apparent continuous deterioration of the belts, whether they are in use or not, so that the depreciation charge is little affected by careful use, provided, of course, the equipment is operated a reasonable amount of the time. This deterioration is largely due to the hardening of the rubber cover and the loss of resilience, and is more apt to be accentuated by idleness than by careful use. The balance of the mechanism is not more greatly affected than other mechanical equipment, if well cared for and not abused. Ordinarily a depreciation charge of 25% on the belt and 10% on the balance of the equipment covers all reasonable wear and tear." His discussion is concerned with conveyors in manufacturing plants. Conveyors in mining and milling are subjected to such hard usage and receive so little proper

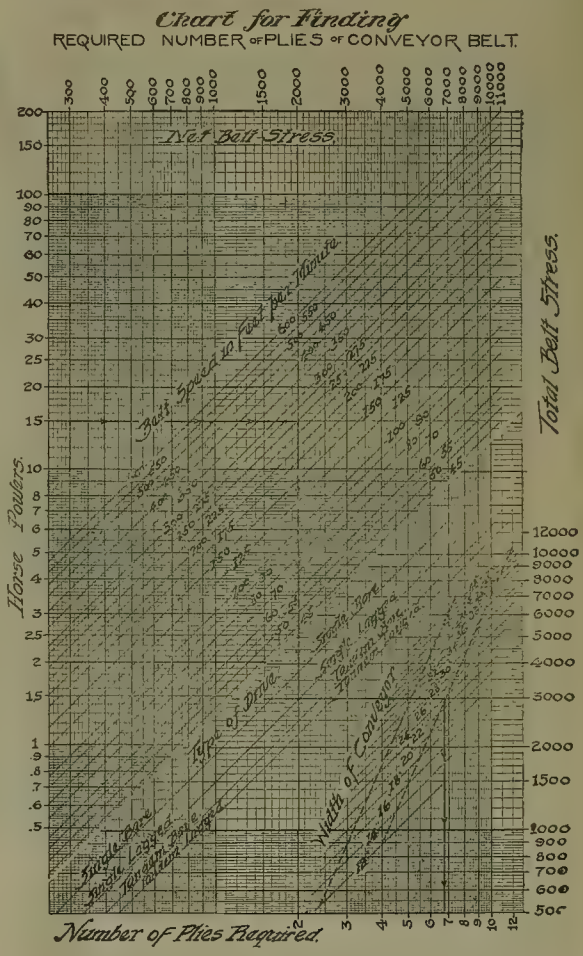


CHART NO. 3. PLIES IN BELT-CONVEYORS

care that their depreciation is undoubtedly far greater than that given above.

APRON AND PAN-CONVEYORS. Modern ore-crushing plants have such large capacities that great tonnages of coarse material must be handled by the conveyors. The heavy wear and the enormous strains to which they are subject make it necessary to replace belt-conveyors with those of a stronger type. For this work, apron-conveyors and pan-conveyors are now largely used. The apron-conveyor consists of a series of steel plates that overlap to form a continuous surface. The plates are carried between two heavy roller-chains, and are rigidly attached

to the inner links. In the large sizes, the plates are supported on cross-bars between the links. A rail on each side carries the rollers. All the framework is of steel. Large sprockets at the ends are used for turning the conveyor. For horizontal work, the overlapping plates are but slightly curved, and the surface of the conveyor is nearly flat. Where cross-bars are used, the plates between are flat. This type is also suitable for work on slight inclinations. For steeper grades the plates are made deeper, and take the form of pans, which may be shallow or deep. For steep grades and for vertical lifts the pans are pivoted, and the conveyor becomes a bucket-elevator. The steel construction of these conveyors guarantees strength to withstand the heavy strains put upon them. The pans can be lined with renewable wooden planks or cast-iron plates, the conveyors thus being protected from wear. The slow speed of these conveyors, from 25 to 100 ft. per min., 75 ft. being a good average, minimizes the wear on the mechanism. Their capacity can be made to suit any requirement; 1500 tons per hour has been carried, and there should be no practical difficulty in handling a larger tonnage. Short conveyors of this type, from 5 to 10 ft. long, are used as feeders. They are run at speeds from 10 to 30 ft. per min., and are placed close to the openings in the bottom of the bins. No gates are required, as the variation in the speed of the feeder regulates the flow of the ore.

Push-Conveyors. Such a conveyor consists of a series of hinged flights attached to a moving frame or carrier. During the forward movement of the carrier, the flights project into a trough and push the material along. On the return stroke, the flights turn up and slide back over the top of the material. This type of conveyor is always of short length, and has a limited use in confined spaces. The moving frame is carried on rollers. The stroke is from 2 to 4 ft. In one mill, two push-conveyors, about 20 ft. long, handled 1000 tons of ore per day. The ore, crushed to $\frac{3}{8}$ in., was supplied to the conveyors by Challenge feeders. The steel flights were $8\frac{1}{2}$ in. wide, 18 in. long, and $\frac{1}{2}$ in. thick; the width of the trough was 22 in.; the length of stroke was 24 in.; and the flights were spaced 18 in. apart to give a 6-in. overlap. The rollers were 8 ft. apart. It was found that the smoothest operation of a conveyor was obtained when the ore was fed at a point about 5 ft. from the end.

Flight-Conveyors. These conveyors consist either of an endless chain or of two roller-chains to which are attached, at intervals, flights or scrapers of various shapes that drag the material along a trough. Their field of operation is confined to relatively small conveyors; the material handled should be non-abrasive, and should have a low co-efficient of friction, such as grain or coal. Wear is caused by the friction of the conveyor on itself as well as by the material carried. The speed of these conveyors varies from 100 to 200 ft. per minute, and they are used on inclines up to 45° from the horizontal. The capacity depends upon the size and spacing of the flights and on the speed. Flights range in size from 4 to 10 in. to 10 by 24 in., and the spacing from 16 to 24 in. For handling coal, the horse-power required $= \frac{ATL + BWS}{1000}$

Where T = tons per hour.
L = length in feet.
W = weight of conveyor (chain and both flights), in pounds.
S = speed in feet per minute.

Table Giving Value of A and B

Deg. from horizontal	A	B	Deg. from horizontal	A	B
0	0.343	0.010	25	0.730	0.009
5	0.420	0.010	30	0.790	0.009
10	0.500	0.010	35	0.850	0.008
15	0.585	0.010	40	0.900	0.008
20	0.660	0.009	45	0.945	0.007

Capacities in Cubic Feet per Minute, at Speed of 100 Feet per Minute

	Spacing			Inclined, 24-in. spacing		
Size of flights	16-in.	18-in.	24-in.	10°	20°	30°
4 by 10	20.8	18.5	13.8	11.1	8.8	6.5
4 " 12	26.3	23.4	17.5	14.8	11.1	8.3
5 " 12	31.9	28.3	21.3	17.5	13.8	10.2
5 " 15	43.0	38.3	28.6	25.0	19.4	13.8
6 " 18	...	49.3	37.0	30.5	24.9	19.4
8 " 18	...	74.0	55.4	44.4	35.1	29.6
8 " 20	...	...	64.5	51.8	41.0	34.5
8 " 24	...	...	83.2	74.0	59.1	44.4
10 " 24	...	...	106.0	92.5	74.0	55.4

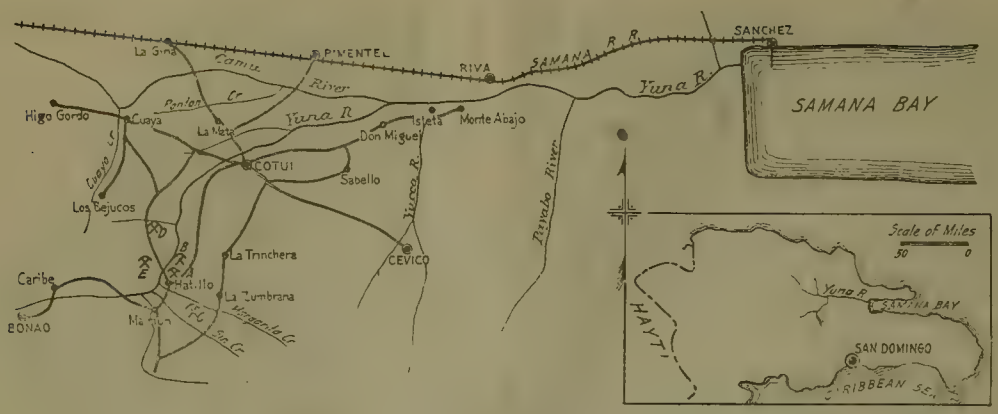
Spiral Conveyors. These consist of a steel ribbon wound in a spiral around a shaft, interrupted at intervals of 8 to 10 ft. for bearings that are 2 to 3 in. long. In the small sizes the spiral fits close to the shaft, but in the larger sizes a narrow ribbon is attached to the shaft by studs. The depth of material is generally taken as one-third the diameter of the screw. The power required varies so greatly with the nature of the material handled that formulas give only approximate results. The weight of material per cubic foot is not always a true measure of its frictional resistance. It is customary to design these conveyors so that the pitch of the screw shall equal the diameter of the conveyor. Because of the great torsional strain involved, lengths are not made greater than 100 ft. For longer distances several conveyors are used in series. Maintenance-charges are high if the material handled is gritty. It is a good plan, with such material, to make the trough large, and to let the material form its own trough. The relatively low first cost and the small space occupied are the chief advantages of this type of conveyor. Coal, coke, ashes, cement, sand, gravel, and crushed stone not over one inch in size are some of the materials that may be handled by spiral conveyors.

$$\text{Horse-power} = \frac{K \times C \times W \times L}{2{,}000{,}000}$$

Where W = weight per cubic foot.
L = length in feet.
C = capacity in cubic feet per hour.
K = 1.2 for grain.
2.5 for fine ashes, cement, etc.
4.0 for sand, coarse, ashes, etc.

The following table, supplied by the Caldwell Co., gives the capacity of spiral conveyors corresponding to their diameters and the appropriate speeds.

Size, inches	R.p.m.	Cu. ft. per hr.	Size, inches	R.p.m.	Cu. ft. per hr.
3	125	20	9	100	421
4	125	43	10	95	540
5	120	95	12	90	933
6	115	126	14	85	1200
7	110	178	16	80	2000
8	105	359			



MAP SHOWING POSITION OF IRON DEPOSITS IN SANTO DOMINGO

Iron in Santo Domingo

By ROBERT B. BRINSMADE

Among the large tropical islands of the West Indies there are none which excel Santo Domingo in picturesqueness of scenery or salubrity of climate. These enchanting endowments are the result of its geological history. The island was formed on the high Cibas range as a backbone, and with its auxiliary ranges disposed as ribs, so that when the body was finally fleshed and made presentable as hill and vale, there was everywhere a soil prolific of riotous vegetation and a drainage nearly ideal for human health. The landscape of much of the interior wilderness reminds one of nothing so much as old prints of the Garden of Eden.

The area of the island is 28,249 square miles, making it nearly as large as South Carolina. Strangely enough the denser population is crowded into the western third of the area, which comprises the Republic of Haiti, with 2,000,000 people, while the Dominican Republic, or Santo Domingo, has only 600,000 inhabitants, and these mostly are concentrated in the seaports. This distribution of the population explains why so much of the interior is covered with primeval forests, with only the occasional cocoa and tobacco plantations of the principal valleys and the meadows for cattle and the sugar brakes of the coastal plains to indicate the presence of man.

Santo Domingo is called the mulatto republic, but most of its people are as black as ebony and can be distinguished from their rivals in Haiti only by speaking Spanish instead of a barborous dialect that was once French. In fact one sees so few light complexions in the interior that black becomes the normal color, and on emerging at a port the white faces appear sickly and almost as unnatural as the chalk-like skins of albinos. The Indians seem to have disappeared entirely; only occasionally does a black face show the red tinge of aboriginal blood. The vice of pilfering is less prevalent in Santo Domingo than in many more highly developed Latin-American countries. This is probably explained by the fact that the masses have never been reduced to peonage as in the countries where a monopoly of land prevails as in Mexico. Most of the older native families have some hereditary rights in the land as comuneros, being descendants of the original grantee of an estate from the Spanish Crown, whereby they are entitled to use any part of the family inheritance that is not already under cultivation. Nevertheless the bulk of the people are but partly domesticated savages, and as such they offer a prolific recruiting ground for the shameless native politicians, whose tumults and rivalries have cursed Dominica for the past century. It is the slaughter of the civil wars, not only of men but of cattle, that has kept the interior a wilderness. Under the treaty of 1907 the United States took charge of the custom houses with the idea of stopping revolutions by shutting off their source of money and arms. For several years this scheme seemed hopeful; but the richness of the island as a source of easily-grown supplies for bandit troops had been forgotten, and conditions rapidly grew worse after the assassination of President Cáceres in 1911, himself the butcher of President Heureux, who had been the island's despot for 20 years. By 1914 the treaty of 1907 had been proved practically useless as a means of checking disorder, for the fifth president had been ousted by violence within the space of one unexpired six-year term. Abandoning moral suasion at long range, the United States finally, in October 1914, sent the Fort Commission to supervise the coming presidential election. Though the peoples' choice, Juan I. Jiménez, was declared elected and duly installed, he soon found his job untenable, and in May 1916 he fled for refuge to our Admiral Knapp, anchored in Santo Domingo harbor. During the summer

of 1916, in order to protect foreign interests, the U. S. Marines captured and garrisoned, with little loss of life, every strategic port and interior town, so that the proclamation of martial law and the assumption of government by Admiral Knapp, in the autumn, simply registered an accomplished fact. Since then the treaty of 1907 has been extended to include the policing of the interior and the control of public expenditures by the United States. At present Santo Domingo is as much a Yankee protectorate as its sister Haiti and the miner need fear no more molestation nor forced loans for the benefit of political 'liberators' than he would in Porto Rico or the Philippines.

In preparing for my trip to Santo Domingo I was unable to find any information concerning its iron deposits beyond the report of the American geologist, W. M. Gabb, who made a survey for the native government, in the decade following 1870, and published a summary in the Transactions of the American Philisophical Society for 1881. Gabb's description is highly misleading, but I quote it as an example of the guesswork that often passes for solemn fact in the transactions of reputable scientific societies. He says:

"On the banks of the Yuna river near Hatillo is a mountain of magnetic iron ore, 100 ft. high, 300 to 400 ft. wide, and many hundred feet long. Three miles westward, across the river, is a second great lens. Owing to the suspicion of the natives, I was unable to obtain a guide to show me the two or three other deposits reported to exist in the vicinity. Samples of the ore I sent to Columbia University for analysis, and they reported 67 to 70% iron and great purity.... Slack-water navigation can be practised on the Yuna below the mouth of the Camu river with less difficulty than in the Schuylkill river in Pennsylvania. From the Camu junction to Hatillo is only 20 miles, and in the dryest seasons the Yuna here is deep enough to float barges anywhere except on the few rapids. These rapids are simply gravel banks that could be made deep enough by confining the stream in a narrower channel or by the use of a dredge. Not a single reef exists in the Yuna from Hatillo to the sea or any difficult descents like the rapids of the Ohio river."

I landed first at Monte Cristi on Manzanillo bay, the westernmost port on the north coast of Santo Domingo. This town marks the western end of the interior east-west valley, which separates the low northern coast or Monte Cristi range, folded from Miocene shales, from the island's backbone, the lofty Cibao.(1) This valley is rather flat, about 140 miles long and 10 to 30 miles wide; its divide is nearly at its centre, near the city of Santiago, whence the Yaqui river flows west to Monte Cristi and the Yuna river in the opposite direction to Samana bay at the eastern end of the island. As the coast range tends to cut off the wet north-east trades from the valley, the rainfall gradually increases eastward from the desert aridity of Monte Cristi to the tropical dampness of the lower Yuna region. My second stop was at the picturesque Puerta Plata, at the foot of the verdure-clad coast range, and, like Monte Cristi, so shallow as to require lighters for handling freight from steamer to shore. Thence following the narrow green coastal plain to the east and rounding the end of the coast range the steamer turned into the well-protected entrance of Samana bay, one of the largest natural harbors on the globe. This bay is about 30 miles long by 10 miles broad, separating the coast from the Cibao range; it is free from rocks and shoals and has deep water on both the north and south shores. The only shallows are at the west end, where the delta of the Yuna river is gradually extending itself eastward. Strangely enough, Sanchez, the terminal port for the Scotch-owned Samana railway, which runs to La Vega 50 miles westward, is not on deep water. Being in the north-west corner just north of the Yuna delta its harbor is silting up, and ocean steamers have to use lighters to handle their cargoes to and from the pier. By going about three miles farther east, Sanchez could have built its wharves by the deep water of the north shore, but as the railway has the monopoly of all lighterage at the port at 50c. per ton, it is not worrying about what 'might have been.'

Hatillo, the centre of the iron district, lies 20 miles south of Pimentel, the nearest railway point, 30 miles west of Sanchez. Though Hatillo is only 50 miles by the road from Sanchez, by the river it is more than twice as far. From Hatillo down to Doneliguel at the mouth of the Camu, the Yuna river descends for 25 miles in a fairly straight line, with a steep gradient, but below Don Miguel, the Yuna begins to meander in its alluvial plain and flows 90 miles to reach Sanchez, while the bee-line distance is only 30. Since the completion of the Samana railway in 1886, it has absorbed most of the river traffic. By pulling the snags, blasting the rocks, and doing some dredging in the channel, it is probable that the Yuna river could be made navigable for small stern-wheel steamers as far as Isleta, 70 miles from Sanchez.

The Cibao range, which borders the Yuna valley on the south, extends the whole length of the island in long parallel folds of Mesozoic and perhaps Paleozoic sedimentary rocks, cut into many peaks by canyons and ravines, and clothed with dense forests to the very top. Between Santiago and the Haitian border the peaks exceed 9000 ft. above sea-level, and here is the centre of a great post-Cambrian batholith, which extends east from the longitude of Monte Cristi to that of the port of Azua. The batholith forms the core of the range, and the sedimentary rocks in its vicinity are considerably metamorphosed.

The beds of several of the rivers, especially the Jaina and Nigua, draining the higher peaks, carry gold, and many millions of ounces of the precious metal were recovered by the companions of Columbus with a few years after their arrival.(2) These ancient gold-seekers seem to have skimmed off the cream within a few years, for the gravels have yielded but little to the native washers in modern times.(3) The failure of several recent attempts by American companies to revive the placer industry merely has served to demonstrate the unpalatable

truth that the 'guileless' native salters are still superior in practical cunning to many a sophisticated foreign sampler.

The low rounded foot-hills of the Cibao range, which dot the Yuna river bottoms near Hatillo, contain the iron-ore deposits. These hills are formed of limestone and porphyry. The former was originally a soft gray rock, but near the contact it is often crystallized or silicified. The porphyry is softer than the limestone and forms the gulches and lower slopes of the hills. In its exposures it is a decomposed yellow matrix enclosing numerous small 'eyes.' The only two examples of unaltered porphyry I was able to find showed it to be andesite having a grayish green matrix with phenocrysts of white feldspar. The only other rock noted in this vicinity was a hard white quartzite found on the hills and showing inclusions of iron oxides.

I examined the five iron deposits, lettered A to E on the map. These were all I was able to find in the district. Their local names are.

A. Sabana de Hatillo.
B. Arroyo Piedra Iman.
C. Arroyo Margarita.
D. Arroyo Jaquez.
E. Loma del Gallo.

All the deposits present a similar appearance on the surface. They show no solid ore, but merely fragments, from the size of a fist to that of a pumpkin, embedded in the clay-like porphyry along its contact with the limestone. They are covered with soil, and often bear trees of considerable size. The following six samples indicate that the ore, such as has been found, is of unsurpassed quality.

	1	2	3	4	5	6
Iron	67.59	67.25	68.15	67.49	69.02	67.05
MnO	0.33	0.20	0.10	0.30	0.30	0.20
S	0.034	0.027	0.020	0.027	0.020	0.048
P	0.040	0.059	0.053	0.050	0.035	0.041
Insoluble	1.90	1.80	2.00	1.60	1.70	1.60
CaO	0.80	0.60	0.40	0.60	0.40	0.30
H_2O	0.30	0.80	0.50	0.60	0.60	0.80
Fe_2O_3 (a)	79.11	80.68	81.96	77.82	80.11	93.32
FeO (b)	5.94	14.52	14.27	17.22	17.22	2.44
Fe_2O_3 to form Fe_3O_4 with (b) = (c)	19.26	17.68	17.73	21.08	21.08	2.52
Fe_2O_3 = (a) — (c)	69.85	63.00	64.23	56.74	59.03	91.30
Fe_3O_4 = (b) + (c)	35.20	32.20	32.00	38.30	38.30	4.96
Ratio, hematite to magnetite	1.98	1.95	2.00	1.48	1.54	18.40

Samples No. 1 to 5 were all from deposit A and show close agreement in the ratio of hematite to magnetite, which carries from 1.48 to 2.00. Sample No. 6 was a piece of float found in the road two miles north of A and of unknown origin; it is nearly pure hematite. These analyses are typical of contact ores and resemble those of lenses in Santiago, Cuba, in Carbon county, Utah, and Fierro, New Mexico. The quality being satisfactory it was next in order to determine the quantity of ore available.

In the surface exposure the deposits varied in area. In deposit C the ore lay along a porphyry dike, between limestone walls, but in all the others it lay with its long dimension following the limestone contact on the porphyry side. Measurement showed the following dimensions:

Deposit	Length, ft.	Breadth, ft.	Acres
A	1020	250	6.3
B	400	200	1.8
C	1700	115	4.5
D	380	240	2.1
E	490	240	2.7
Total			17.4

It was decided to prospect deposit A by sinking test pits at regular intervals. In going over the surface to locate sites for these pits, a number of old caved holes were discovered, and inquiry proved them to be the work of a French engineer named Fieux, who had sunk them about 1891, with negative results as to the finding of ore in place. It was therefore no surprise to have the new test-pits invariably 'bottom' in the barren decomposed porphyry after passing through a few feet of the surface blanket of ore fragments and clay. Having only dug 14 pits, the number was perhaps insufficient to affirm the absence of any solid ore in the hill, but the pits certainly demonstrated that deposit A was nothing like the 'mountain of magnetic iron ore' that Gabb had dubbed it. The commercial feasibility of the proposed project for development depended on the existence of at least a million tons of iron in deposit A, while the blanket of fragments contained only a tenth of that quantity. As deposits B and D had both been dug over by M. Fieux in 1891 and had been shown to be similar in type to deposit A, further investigation was useless. The remaining deposits, C and E, are on hills some distance from the proposed Yuna river transportation. If solid ore can be found below any of these detrital deposits, it is probably in deposit C, which occurs in a trench between limestone walls, and may thus have survived the erosion that seems to have destroyed the other ancient lenses, leaving nothing but the debris of their roots as evidence of their former existence.

The theory that these deposits came from lenses *in situ* seems the only tenable one; both because each lies directly along the lime-porphyry contact and the nature of the ore is identical with that of solid contact lenses in other districts. The fact that only five hills out of many similar ones as to height and age in this locality, contain such deposits indicates that the detritus does not represent the remnants of a continuous stream bed or blanket of ore which may be reduced from its original to its present condition by erosion of the Yuma valley.

Should the Samana railway ever be extended as far as Hatillo, it would then be feasible to develop these iron 'placers' for export. Mining could be done by wheeled scrapers or steam shovels, and the chunks of ore could be cleaned from their clayey matrix by log washers. At least 300,000 tons of high-grade ore could be extracted by such operations. To better this quantity there would be a chance of finding other deposits, besides the five now known, and also of discovering one or more lenses of solid ore after the residual masses had once been scraped off their tops.

REFERENCES

(1) 'Cuba, Puerto Rico, and Other W. I. Islands,' by R. J. Hill, New York, 1898.
(2) 'Report of U. S. Commission on Santo Domingo,' Washington, D. C., 1871.
(3) 'Santo Domingo, Past and Present,' New York, 1873.

War Minerals Control

Herewith we give, verbatim, the text of the new bill introduced by Senator Henderson.

A bill to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of certain ores, metals, minerals, intermediate metallurgical products, alloys, and chemical compounds thereof, including power to the United States to contract therefor; to requisition and sell the same; to acquire and develop lands and plants producing or capable of producing the same; making appropriations therefor, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That by reason of the existence of a state of war, it is essential to the national security and defense, and to the successful prosecution of the war, and for the support and maintenance of the Army and Navy, to provide for an adequate and increased supply, to facilitate the production, and to provide for an equitable and better distribution of the following-named mineral substances and ores, minerals, intermediate metallurgical products, metals, alloys, and chemical compounds thereof, to wit: Antimony, arsenic, ball clay, bismuth, bromine, cerium, chalk, chromium, cobalt, corundum, emery, fluorspar, ferro-silicon, fullers' earth, graphite, grinding pebbles, iridium, kaolin, magnesite, manganese, mercury, mica, molybdenum, osmium, sodium, platinum, palladium, paper clay, phosphorus, potassium, pyrites, radium, sulphur, thorium, tin, titanium, tungsten, uranium, vanadium, zirconium, and of such other rare or unusual elements as the President may, from time to time, determine to be necessary for the purposes aforesaid, and as to which there is at the time of such determination, a present or prospective inadequacy of supply; to accomplish which purposes this Act is passed. The aforesaid substances mentioned in any such determination are hereinafter referred to as necessaries.

SEC. 2. That the President is authorized from time to time to enter into, to accept, to transfer, and to assign contracts for the production or purchase of necessaries, to provide storage facilities for and store the same, to provide or improve transportation facilities, and to use, distribute, or allocate said necessaries, or to sell the same at reasonable prices: *Provided,* That no such contract of purchase shall cover a period longer than two years after the termination of the war.

The President is further authorized, upon finding that importation into the United States of any of the necessaries covered by this Act is likely to result in a loss to the United States on any necessaries which it may have acquired hereunder, to ascertain, fix, and proclaim such rate of duty upon such imported necessaries as shall be sufficient to adequately protect the United States from any such loss.

The funds provided by section 6 hereof shall be used in carrying out the powers granted by this section, and all moneys received by the United States from or in connection with the disposal of such necessaries, shall be used as a revolving fund for further carrying out the purposes of this Act. Any balance of such moneys remaining when the object of this Act has been accomplished, shall, as collected, received, and on hand and available, be covered into the Treasury as miscellaneous receipts.

SEC. 3. That the President is authorized to requisition and take over any of said necessaries, to provide storage facilities for and to store the same, and to use, distribute, allocate, or sell the same; and also to requisition and take over any undeveloped, insufficiently developed or operated, or idle land or deposit, mine, smelter, or plant, or part thereof, producing or, in his judgment, capable of producing said necessaries, and to develop and operate the same, either through the agencies hereinafter mentioned, or under lease, royalty, agreement, or in any other manner, and to store, use, distribute, allocate, or sell the products thereof. Whenever the President shall determine that the further use or operation by the Government of any such land, deposit, mine, smelter, or plant, or part thereof, so acquired, is no longer essential for the objects aforesaid, the same shall be returned to the person, firm, or corporation entitled thereto. The United States shall make just compensation, determined by the President, for the taking over, use, occupation, or operation by the Government of any such necessaries, or any such land, deposit, mine, smelter, or plant, or part thereof. If the compensation so determined be unsatisfactory to the person, firm, or corporation entitled thereto, such person, firm, or corporation shall be paid seventy-five per centum of the amount so determined and shall be entitled to sue the United States to recover such further sum as added to said seventy-five per centum will make up such amount as will be just compensation, in the manner provided by section twenty-four, paragraph twenty, and section one hundred forty-five, of the Judicial Code.

The President is authorized to require statements and reports, to examine books and papers, and to prescribe such rules and regulations as he may deem appropriate for carrying out the purposes of this section, including the operation of any such land, deposit, mine, smelter or plant, or part thereof, the purchase, use, sale or other disposition of articles or substances used, manufactured, produced, or mined therein, and the employment, control, and compensation of employees. The fund provided by section six hereof may be used in carrying out the purposes of this section, and all moneys received by the United States from or in connection with the use, operation, or disposal of any such necessaries, land, de-

posit, mine, smelter or plant, or part thereof, shall be used as a revolving fund for further carrying out the purposes of this Act. Any balance of such moneys remaining when the objects of this Act have been accomplished, shall, as collected, received, and on hand and available, be covered into the Treasury as miscellaneous receipts.

SEC. 4. That any person who shall neglect or refuse to comply with any order or requisition made by the President pursuant to the provisions of this Act, or who shall obstruct or attempt to obstruct the enforcement of or the compliance with any such requisition or order, or who shall violate any of the provisions hereof, or any rule or regulation adopted hereunder, shall, upon conviction, be fined not exceeding $5000, or be imprisoned for not more than two years, or both.

SEC. 5. That the sum of $500,000 is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated, to be available until June thirtieth, nineteen hundred and nineteen, for the payment of all administrative expenses under this Act, including personal services, traveling and subsistence expenses, the payment of rent, the purchase of equipment, supplies, postage, printing, publications, and such other articles, both in the District of Columbia and elsewhere, as the President may deem essential.

SEC. 6. That the sum of $50,000,000 is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated, which, together with all moneys received from time to time under the provisions of this Act, all of which shall be credited to said appropriation, shall be used as a revolving fund for carrying out the objects of this Act, and for the purpose of making all payments and disbursements, including just compensation under section 3, by this Act authorized: *Provided,* That no part of this appropriation shall be expended for the purposes described in the preceding section: *Provided further,* That a detailed report of all operations under this Act, including all receipts and disbursements, shall be filed with the Secretary of the Senate and Clerk of the House of Representatives on or before the twenty-fifth day of each month, covering the preceding month's operation. Any balance of said revolving fund remaining when the objects of this Act have been accomplished, shall, as collected, received, and on hand and available, be covered into the Treasury as miscellaneous receipts.

SEC. 7. That the President is authorized to exercise each, every, or any power and authority hereby vested in him, and to expend the moneys herein appropriated or provided for, or any part or parts thereof, by and through such officer or officers, department or departments, board or boards, agent, agents or agencies as he shall create or designate, from time to time, for the purpose. He may fix the reasonable compensation for the performance of such services, but no official or employee of the United States shall receive any additional compensation for such services except as now permitted by law.

SEC. 8. That the President is authorized, if in his judgment such action be necessary or useful for the objects of this Act, to form one or more corporations under the laws of any State, Territory, District, or possession of the United States, for the purpose of carrying out the powers or any of the powers hereby authorized. The capital stock of any such corporation shall be such as the President may determine, but the total capital stock for all corporations so formed shall not exceed in the aggregate the appropriation of $50,000,000, made by section six hereof. Said appropriation, or any part thereof, may be used by the President in subscribing on behalf of the United States, through such person or persons as he may designate, to the capital stock of such corporation or corporations, and the capital and assets of any such corporation or corporations, together with all additions thereto under sections two and three hereof, may be used in carrying out the objects of this Act. The directorate and organization of such corporation or corporations shall be such as the President may prescribe, and such corporation or corporations shall have all such charter powers as may be necessary or desirable to enable it or them to accomplish the objects of this Act. The capital stock of any such corporation or corporations shall be held and voted for the exclusive benefit of the United States, through such person or persons as the President may designate.

SEC. 9. That the powers and authority granted by this Act shall cease upon the expiration of two years after the termination of the war, and within said period the President, and any officer, department, board, agent, agency or corporation carrying out the provisions of this Act, shall dispose of any necessaries, land, deposit, mine, smelter or plant, or part thereof, held by him or it hereunder, and shall fulfill the terms of any contract made hereunder, and thereupon any such corporation or corporations shall be dissolved; *Provided,* That the termination of this Act shall not prevent the subsequent collection of any moneys due the United States, nor shall it affect any act done or any right or obligation accrued or accruing, or any suit or proceeding had or commenced before such termination, but all such collections, rights, obligations, suits and proceedings shall continue as if this Act had not terminated, and any offense committed or liability incurred prior thereto shall be prosecuted in the same manner and with the same punishment and effect as if this Act had not terminated.

SEC. 10. That if any section or provision of this Act shall be declared invalid for any reason whatsoever, such invalidity shall not be construed to affect the validity of any other section or provision hereof.

INSUFFICIENT LIGHTING CONDITIONS are held to be responsible for at least 25% of the avoidable accidents to workmen in the United States. From July to December each year there is an increase of accidents per month, the 'peak' occurring in the darkest months of the year. From mid-January to June there is a drop in casualties. Poor lighting in mines and works results in a desire to avoid such places, accidents, and lower efficiency. Much better work is done when there is plenty of light.

SPOKANE, WASHINGTON

Proceedings of the Gold Conference.

The International Gold Conference, convened by the Northwest Mining Association, sat here on September 5 and 6. Discussion of the important features appears on another page of this issue of the 'Press.' G. B. Dennis, president of the Association, made the address of welcome. F. A. Ross was temporary chairman, Judge George Turner permanent chairman, and Sidney Norman was secretary.

A paper entitled 'The Necessity of Maintaining the Gold Reserve,' was read by G. H. Greenwood of the Old National bank of Spokane. He thought that the payment of a bounty was a possibility. Courtenay De Kalb, of the 'Mining and Scientific Press,' said that American bankers were very much interested in the problem. If gold is left in the mines a great power remained inactive. F. A. Ross, in his paper, 'The Gold Situation and Its Remedies,' favored a bounty. M. D. Leehey of Seattle, representing Alaska, also wanted a bonus. F. A. Thomson, of the Idaho School of Mines, considered that a bonus on new gold would stimulate the opening of new ground. The central Idaho gold belt has favorable possibilities. J. N. Pickell of Orogrande, Idaho, thought that the provision of facilities for gold mining was more essential than a bonus. The Government should improve the roads. The present cost of hauling supplies was often greater than their value. Stanly A. Easton, of the Bunker Hill & Sullivan, prepared a paper 'The Relation of Labor to Mining,' but was unable to attend the meeting. W. Fleet Robertson, Provincial Mineralogist of British Columbia, thought that the expectation in the form of a bounty should not be based upon the content of the ore. There were deductions for smelting and loss that should be given consideration. The following table, prepared by Mr. Robertson, shows the source of gold and estimates for 1918 for British Columbia:

Source	1914 oz.	1917 oz.	Estimate, 1918 oz.
Stamp-mill	60,477	40,480	35,000
Smelters:			
Gold-copper ore	138,867	36,314	50,000
Copper-gold ore	44,502	53,890	32,000
Silver-lead ore	3,324	3,760	3,500
Miscellaneous	.....	74	.....
	247,170	114,523	120,500
Placer gold	28,250	24,800	17,500
Total	275,420	139,323	138,000

1917 Percentages of Value in Ores

	Gold, %	Silver, %	Copper, %	Tons,
Stamp-mills	97.30	2.70	....	72,071
Smelters:				
Gold-copper ores	58.45	4.04	37.50	107,712
Copper-gold ores	4.31	2.34	93.35	2,025,124
Dry silver-lead ores	46.62	53.38	....	.....
Miscellaneous	....	....	....	4,078

There was a large attendance at the conference, including the following list, totaling 124 delegates:

Alaska.—Jack Irvine, interior; Maurice D. Leehey, of Seattle and Seward; O. G. Robinson, Yenta district, Cache creek; and E. D. Reiter, Valdez.

British Columbia.—William Fleet Robertson, Provincial mineralogist; J. H. Jackson, Granby; Ernest Levy, Rossland Board of Trade, and manager of Le Roi No. 2; R. F. Green, member of Parliament for West Kootenay; J. J. Warren, at Trail smelter; W. M. Archibald, consulting engineer Consolidated M. & S. Co.; C. E. Bennett; Harry Wright; Charles Caldwell, president Mine Owners Association of the Kootenays; Thomas Butler; P. H. Clark; C. C. Ladd; and R. A. Stewart.

California.—Courtenay De Kalb, representing American Gold Conference of Reno; and George H. Tweedy, representing northern California.

Idaho.—Robert N. Bell, State Mine Inspector; A. J. Devlin; E. H. Lindley, president University of Idaho; Paul Bockmier, Gold Creek district; Francis A. Thomson, School of

PART OF THE NORTH-WEST

Mines, University of Idaho; W. L. Penick, representing War Minerals Committee; E. M. Griffith, Grangeville district; F. D. Leeper, A. W. Boyd, W. C. McNutt, J. M. McLean, and Phil. Hartman, Elk City district; M. A. Sherman, J. E. Pickrell, and J. N. Pickrell, Orogrande district; M. J. Barrett, F. F. Smith, and John Grinde, Ten Mile district; Stephen M. Smith, Boise district; A. M. Wilton, Boise Basin district; Joseph Pelikan, B. L. Schultz, R. Wethered, Edward Rudolph, and G. K. Reed, Buffalo Hump district; G. R. Calvin, Pine Grove district; H. E. Hewitt; R. M. Wank; and R. J. McLin, Dixie district.

Minnesota.—A. R. Amundsen, Loon Lake district, Washington.

Montana.—William Muth, F. S. Earnest, R. A. McCray, Charles Heibronner, and L. S. Ropes, Helena district; T. S. Eckholm and Joseph Garneau, McClellan district; A. W. Patterson, Anaconda district; W. M. Manning and P. B. Bennett, Lewis and Clark county.

Nevada.—Eugene Davis, representing American Gold Conference; and Oscar Gillice.

Oregon.—H. N. Lawrie, representing American Gold Conference; E. D. Whitney, Portland Chamber of Commerce; A. F. Dixon, Susanville; Robert M. Betts, Cornucopia district; H. C. Mahon, president Champion Mines Co.; W. Burnham, Baker county; and George W. DeWitt, of Greenhorn and Susanville.

Washington.—The Governor, Ernest Lister; W. E. Mann; S. A. McCoy, Stevens county; C. G. Warfel, State School of Mines; L. H. Markham, Okanogan district; C. P. Robbins, Richard March, G. S. Bailey, John Byrne, J. W. Turner, and D. M. Drumheller, Jr., Republic district; Martin J. Maloney, Washington district; A. L. Flewelling, C. P. Oudin, P. P. Rooney, F. C. Robertson, C. M. Fassett, J. J. Hennessy, Orient district; Thaddeus S. Lane, president Chamber of Commerce; G. H. Harrington, Boundary district; A. H. Perkins; Albert Ansell; J. H. Lynch; H. H. Shallenberger; E. H. Lindley, president University of Idaho; E. T. Coman, president Exchange National; C. A. Batchelder; M. D. Couch and Will Everett, representing Wallace & Wallace; Lewis P. Larsen, Metaline district; L. Oriand, Chesaw district; Jerome L. Drumheller; J. M. McBride, Myers Creek district; F. O. Bowman; H. J. Ellard; W. H. Agens; J. W. Feighner; E. H. McDonald; Story Buck; J. M. Porter; S. L. Boyer; John H. Eachan; J. E. Leonard; and Forest Fraser, Keller district; L. K. Armstrong; Russell Collins; William Hammer; C. A. Gray; V. P. Adams; C. A. Long; H. F. Herkebrath; W. J. Harris; M. B. Morrow; John Copeman; J. P. Loring; and Robert Ferguson.

PORTLAND, OREGON

Bankers Discuss the Gold Situation.

On September 5, a conference was held here under the auspices of the Oregon Bankers Association, to consider the status of gold production. Bankers from Washington and California were also present. E. G. Crawford presided. John Clausen, vice-president of the Crocker National Bank, San Francisco, was the principal speaker. He briefly covered the work of the American Gold Conference at Reno on August 12, and the condition of gold and credit throughout the world.

The resolutions adopted by the Association are given in full on another page of this issue.

The bankers heartily approved of the appointment by the Secretary of the Interior of a committee to study the increased cost and the decreased output of gold in order that the gold production of the United States may be maintained at its pre-war value, also, that the chairman or secretary of this convention be instructed to present these resolutions to the American Bankers Convention to be held at Chicago, commencing September 23, 1918.

VICTORIA, BRITISH COLUMBIA

Gold Receipts.—Granby Consolidated Closes Phoenix Mines.—Tidewater Copper Mine Re-opened.—Mine-Rescue Meet.—Development in Western Mining District.

Gold bullion deposited at the Dominion Assay Office at Vancouver during August was valued at $608,838. This is an increase of $253,846 over the same month of 1917. Most of this bullion came from the Yukon.

The Boundary district has suffered a blow by the recent closing of the Phoenix mines of the Granby Consolidated, with the consequent cessation of smelting at Grand Forks. This also means a serious loss to the West Kootenay Power & Light Co., which for years has supplied power for the reduction works, and to the small mine operators who made ore shipments to the smelter. Many employees will be thrown out of work. The company states that it is no longer profitable to treat the low-grade ore of the Phoenix mines. The increases in the cost of hydro-electric power, coke, and freight-rates were largely responsible. These mines have been operated for some time on a narrow margin, it costing 22½c. per pound to produce copper from the Phoenix ores. With the fixed price of 23½c. there was a profit of 1c., but the subsequent increase to 26c. did not make the difference that might have been expected, owing to the rise in freight-rates at the same time. Operation of the Phoenix mines began in 1910, when, under the management of the Granby company, it produced 169,087 tons of ore. In that year the first furnace of 300-ton capacity was completed and produced 8871 oz. of gold, 34,990 oz. of silver, and 5,435,955 lb. of copper. Additions to the plant were made until its daily capacity reached 4500 tons. The converter plant was started at Grand Forks in 1902, and its capacity increased in 1909. The mines are estimated to have produced up to the end of the last financial year, ore valued at $55,550,000, or nearly 10% of the total mineral production of the Province up to June 30, 1917. Hope has not been abandoned of persuading the Granby company to continue operations in this district, and J. E. Thompson, member of the local legislature for Grand Forks, states that the company's plans must not be accepted as contemplating abandonment of the property even temporarily. He asserts it is most probable that after some repairs to plant the industry will be re-established,

The Tidewater Copper Co., Sidney inlet, Vancouver Island, according to W. G. Tanner, vice-president, is carrying on extensive development. At present, old workings are being re-opened. To facilitate transportation a tunnel is being driven through the mountain, while a tramway is under construction connecting with the bunkers and wharf. A shipment valued at $20,000 was made recently to the Tacoma smelter. The Tidewater is an old and well-known mine, having been operated first by the late Lieutenant-Governor Dwedney and associates. It shipped 10,000 tons of 4% ore, and did development to the point of uncovering a considerable body of good ore. At that time the price of copper was not high enough to make work profitable and the mine was closed. Present prices resulted in its being re-opened.

The coal-miners of Nanaimo, Ladysmith, Extension, Wellington, and Comox were well represented at the annual meeting of the Vancouver Island Mine Safety Association, held at Cumberland on September 2. The mine-rescue and first-aid competitions were of high standard and were keenly contested.

The resident mining engineer for the western district of British Columbia, W. M. Brewer, is enthusiastic regarding present conditions in that region. In over 20 years he has never seen prospects more encouraging. The Phelps Dodge (Arizona) interests have taken bonds on the Fraser claims (East Sooke); the Ladysmith Smelting Corporation has bonded the Willow Grouse, Cowichan lake; the Ralph properties are under charge of Mr. Aldrich of New York, ex-manager of the Trail smelter; and the Sunlock mines, Jordan river, are being run by Patrick Stewart for a Vancouver company. In the Alberni Canal region Samuel Ryder, of St. Albans, England, has erected new bunkers and a compressor-plant at the old Monitor mine, which was sold three years ago for taxes. It is reported that a large orebody has been developed. At Quatsino sound, also Vancouver Island, the Coast Copper Co. is working the Old Sport group on Elk lake, and plans are said to be under way for a 16-mile railroad from the mines to the coast. At Sidney inlet, the Tidewater Copper Co. of New York is working the Indian Chief group, a former Dwedney holding; and at Knights inlet the Princess and Union groups are being operated. Work is proceeding on the Texada Island properties and prospecting forces are working everywhere, particularly on Jervis inlet.

THE MINING SUMMARY

ALASKA

Anchorage.—William Martin, operating the Gold Cord mine in the Willow Creek district under a short-term lease, reports that the first mill test of 40 tons of ore yielded $70.46 per ton. Tailing assayed $12 per ton, which was reduced to 80 cents in the cyanide plant. The mill has a capacity of 35 tons per day, and will continue to operate until November 1.

A Straub stamp-mill (circular type) is being erected at the Miller-Bartholf prospect.

Owners of the Mabel mine are reported to have found the vein which was lost by faulting.

There has been considerable prospecting for chromite on

PROSPECTING FOR QUARTZ VEINS AT FAIRBANKS, ALASKA

the lower Kenai peninsula during the summer, but no new discoveries are reported.——A. C. Gill, of the University of California, has been studying the chromite deposits for the U. S. Geological Survey.——Whitney & Lass, mining chromite at Port Chatham, have been shipping regularly, between 400 and 500 tons being mined from a deposit between high and low tides. Operations are under way to mine ore on the mainland. A mill, consisting of 10 stamps and a Frue vanner, is being erected, together with a tram and wharf.

Californian interests have had an examination made of gold-quartz prospects at Nuka bay.

C. H. Packard is prospecting a graphite deposit at Red Bluff, on Seldovia bay.

Employees of the Alaskan Engineering Commission have rejected an increase of 10% in wages offered by the Commission. With a committee from the Anchorage Chamber of Commerce they have taken up the matter with the Secretary of the Interior at Washington.

The U. S. Geological Survey has opened an office at Anchorage. Theodore Chapin is in charge.

Port Chatham.—Prospecting for chrome at Red mountain, on Kenai peninsula, and seven miles from the Pacific tidewater, has disclosed 50,000 tons of high-grade ore. W. P. Lass, formerly at the Alaska Treadwell at Juneau, is part-owner and manager of this venture.

ARIZONA

Bisbee.—A carload of copper ore is being shipped daily from the Higgins lease. This ore carries 700 lb. (35%) copper per ton.

Canon.—The Kay Copper Co., operating at this place, 25 miles south of Mayer, in charge of G. W. Long of Oatman, reports encouraging results. The old 500-ft. shaft was repaired when the new owners recently took over the mine from S. J. Tribolet of Phoenix. A south drift at this depth cut an orebody 12 ft. wide. The 5-ft. face assayed 18.4% copper, 1.35 oz. silver, and $1.40 gold; and the 7 ft. of drillings somewhat higher. The full width has not yet been determined.

Globe.—East of the McGaw fault, on the No. 9 and 10 levels, the Superior & Boston has opened 15% copper ore. On the level above this shoot has been driven 70 ft., with 19 ft. of ore in the face.

Hackberry.—The main shaft on the Hackberry mine has reached a depth of 800 ft. The vein has been cross-cut at the 700-ft. level and 100 ft. of driving done. The ore on this level is said to be as good as on the upper levels. Construction of the mill is progressing rapidly.

Kingman.—The Rico Exploration Co., operating north of here in the Wallapai district, cut the vein at a depth of 140 ft. It was 4½ ft. wide, 2½ ft. of which assayed $91.65 per ton in gold and silver; the remainder $20 per ton. A 5-in. streak is said to assay 800 oz. silver per ton. The shaft is to be continued to 200 ft. W. W. Lewis is manager.

The Cactus Queen Mining Co., in the Owen district, has purchased $30,000 worth of machinery. As soon as erected the shaft is to be sunk to the 500-ft. level. Development on the 150-ft. level has exposed 6% ore, carrying gold and silver.

The trial run at the George Washington mill, at Mineral Park, was a complete success. The plant is now in continuous operation, making an extraction of 92%.

The Copper World mine, 14 miles east of Yucca, has been taken under option by Charles Adams and associates. The mine will be unwatered and developed. This property is owned by the Commercial Mining Co., a subsidiary of the Phelps Dodge Corporation.

The first dividend, amounting to $20,000, has been declared by the Yucca Tungsten Company.

Mayer.—At the fork of Ash creek and Agua Fria river, 12 miles south-east of here, Bunker & Burmeister have two manganese mines. One of them is leased to B. Sherwin of Mayer. A contract has been arranged with the Western Ore Purchasing Co. of Reno, Nevada, for 15 tons daily from the two mines.

In the Copper Mountain district, the Big Bug Copper Co. is moving a gasoline hoist from a property that it owns north of the Blue Bell mine, to the shaft being sunk on the north-east side of Copper mountain. At a depth of 70 ft., shipping-ore fills the shaft-bottom.

Something good is sure to come from the work being done on nearly all of the new properties in this district. W. A.

Tucker, who represents a large interest in the Barbara mine, came from Bisbee last week to consult with the owners at Mayer, on a proposed sale of the property.

The Christmas group, owned by the Jerome Copper Co., has been bonded to New Yorkers, and shipments of surface ore have been arranged for the Humboldt smelter.——The adjoining property, the Hall, it is understood, is tied up in a deal with prominent Western men.

St. Louis people have organized the Liberty Copper Co. on the Jeane claims, which are west of the A. B. C. mine, and it is stated that extensive development is to begin soon.

Dr. Vivian, William Belford, and others, owners of the Little Egypt, have organized a company.

The Western Copper Co., recently organized, has taken over large holdings south of the Half Moon, and the old Patton mine, which adjoins the Copper Queen on the south. A new shaft has found high-grade copper ore of considerable promise.——The Patton mine also carries the south extension of the ore zone of the Copper Queen and A. B. C. mines. The president of the company is W. W. Lawson, of Phoenix, and the general manager is W. D. Mahoney, of Jerome.

Stoddard.—The Arizona Binghampton's flotation plant has been working for two years. The recovery has been consistently high. The present tonnage is 180 per day.

Superior.—Magma Copper pays 50 cents per share on September 30. This is equal to $120,000.

St. Thomas.—The Grand Gulch copper mine continues to yield rich ore, which is sent to smelters in Utah.

ARKANSAS

Yellville.—According to A. N. Stanfield, mining near Rush, the committee that allocates the zinc concentrate which is fixed at $75 per ton, does not give the smaller producers a fair chance. He has protested to the War Industries Board to that effect.

CALIFORNIA

Angels.—The Utica mine has been closed and the plant will be sold. The superintendent, F. J. Martin, goes to his ranch in Arizona.——The Gold Cliff mine adjoining will be worked in charge of A. C. Wilson. A bulkhead on the 1500-ft. level of the Utica will prevent water from flooding the Gold Cliff.

Cloverdale.—The Esperanza quicksilver mine has been shut-down. The ore yielded under 0.5% mercury, and the furnace was inefficient.

Crescent Mills.—Machinery is being dismantled and work at the local gold mine stopped. Reasons for this are unknown at present.

Engelmine.—An amusement hall, including dance-floor, billiard and pool-rooms, and barber-shop, are to be the first of several large buildings erected at the Lower Camp. An office building, commissary, and hotel are also being planned. An addition is being made to the 'Superior' plant for the installation of a new Hardinge mill. Mine timbers and buildings consume the entire output of the company's sawmill, which has a daily capacity of 18,000 board feet.

The Trask Copper Mining Co., on this belt, two miles from Engelmine, has started work on a 20-ton flotation mill. Development at the mine has been discontinued until the mill is completed. With ore carrying 3 to 4% copper, 12 oz. silver, and $2 gold, the owners expect that their concentrate will more than pay for development.

Development of the Snowstorm claim is under the management of H. E. Bush. Indications are encouraging. Mr. Bush is well known from his work at the Engels mine.

A. L. Beardsley is directing development operations at the Tri-Metallic mine, which joins the west line of the Engels mine.

Genesee.—Plans are being prepared for erection of a concentrating plant at the Beardsley mine, north of Genesee. The property is owned by M. J. Smith and A. L. Beardsley. Three large copper-silver orebodies have been opened by tunnels and core-drilling. This is one of the most interesting developments in the district.

Happy Camp.—It is reported here that the Mason Valley Mines Co. of Nevada might erect a concentrating plant at its Gray Eagle copper mine, in Siskiyou county. This district is producing some chrome, which is hauled to rail at Hornbrook.

Porterville.—Mining in this district is quiet at present. The Porterville Magnesite Co. is operating. The Tulare Mining Co. is the only one whose work has been anything near normal, as its magnesite goes no farther east than the Mississippi, hence it is not affected by the freight situation. It is rumored the American Magnesite Co., whose calcining plant at Porterville has been shut-down for some time, is to resume soon.

The San Joaquin Portland Cement Co. has been incorporated with a captial of $750,000. A property of 160 acres, 8 miles east of Porterville, has been purchased. It contains a large deposit of limestone and clay, to be used in the 1000-bbl. cement plant to be erected. Potash will be recovered from the dust by the Cottrell system. J. T. Humburg of San Francisco heads the company. W. J. Gingee will supervise construction of the plant.

Quincy.—Shipments of ore from the McCarthy-Eddlebottle chrome mines, on the middle fork of the Feather river, back of Claremont range, have already begun. Forty mules have been brought here to carry the ore a distance of three miles. It is then hauled in wagons to the railroad at Quincy Junction. The ore is being shipped by the Union Chrome Co., which has given the contract for hauling to William Patrick at $3 per ton. The ore assays 46% Cr_2O_3, with only a small amount of silica.

The old Bushman mine, at Newton Flat, four miles north of Quincy, is about to be started again. The old shaft is being cleaned out, and preparations made to open new gravel channels. This mine has been a big gold producer in the past, and much faith is being placed in the unworked gravel. The mine is owned by C. D. Hazzard of Quincy, but will be worked at present by Kelsey & Wilson.

Keswick.—The Scottish Chief mine, three miles from this place, is to have a 30-ton mill, the type yet to be decided. M. A. Maher is superintendent. The mine is opening pretty well, after development carried on for the last three years.

Yreka.—The Eastern Mining Co., which is mining chrome near Gottville, has discovered a deposit at Dannemore, in the Siskiyou mountains, near the Oregon line. The ore has to be taken to rail at Hornbrook, a long haul. The chrome content is 42%, with a little manganese.

COLORADO

Cripple Creek.—Gold output of the district in August totaled $849,612 from 78,900 tons of ore. This is $63,000 less than in July.

Dividends paid during the month were $122,000 by the Cresson and $45,000 by the Portland.

Leadville.—M. L. Buchanan and others, who comprise a combination of manganese producers, have secured a lease on the A. V. shaft in California gulch. After repairing the shaft and doing some work on the 400-ft. level, 35% ore was opened.

The Greenback mine in Graham park is being equipped and prepared for a larger output, in charge of H. C. Watson. Ore shipments are being made to the Western Chemical Co. of Denver.

Lessees at the Chrysolite mine on Fryer hill have opened 5 oz. silver and 46% iron ore.

The Anderson tunnel on Prospect mountain is being extended 750 ft., making it 2300 ft. long.

IDAHO

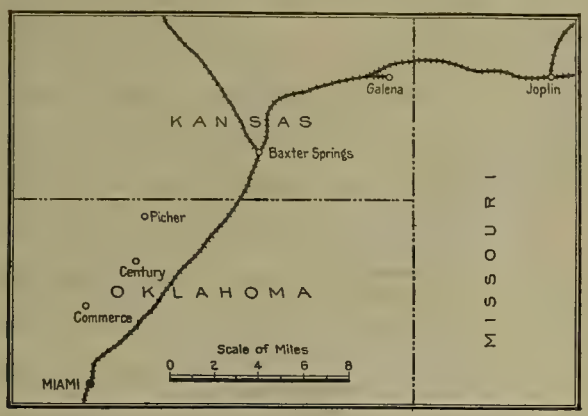
Arco.—The Wilbert Mining Co.'s 100-ton mill was destroyed by fire on August 31. The boiler-house, assay-office, water-tanks, and part of the ore-bins were burned. The plant was insured for $42,000. Incendiarism is suspected.

Mullan.—The National copper mine is opening satisfactorily. At 1400 ft. depth the ore-shoot is 125 ft. long, while on the 1200, 1000, 900, and 800-ft. levels good ore is being mined. A new hoist and electric pump are being put in. The 500-ton mill is working a third of full time.

KANSAS

Baxter Springs.—There are 20 concentrating mills in the Baxter district, 12 of which are producing zinc concentrate. The output two weeks ago was 714 tons.

The Chanute Spelter Co. (American Metal Co.) is completing a 700-ton mill near here. Two large Pomona pumps are discharging a big quantity of water from the mine.



MAP SHOWING RELATION OF KANSAS DISTRICT TO MISSOURI AND OKLAHOMA FIELDS

MICHIGAN

Houghton.—Dividends declared by Michigan copper companies are as under:

Company	Amount per share	Date	Total for 1918
Ahmeek	$2.00	Sept. 27	$8.00
Allouez	1.50	" 25	6.00
Calumet & Hecla	15.00	" 20	40.00
Copper Range	1.50	" 14	4.50
Isle Royale	0.50	" 27	0.50
Osceola	2.00	" 27	8.00
Quincy	2.00	" 30	6.50
Wolverine	1.00	Oct. 1	4.00

MISSOURI

Aurora.—Miners of silicate (calamine) ore are more active than before, due to the better market for their product. The output last week was 202 tons, worth $32 per ton.

Joplin.—Production of the region last week was 7593 tons of blende, 844 tons of calamine, and 1042 tons of lead. Zinc concentrate dropped $2.50 per ton to $52.50; calamine was firm at $35 to $40; and lead was steady at $100. The total value was $500,535, of which Missouri contributed $181,976.

Oronogo.—The Oronogo Mutual mine has been sold by the Waring family to C. T. Orr. Guy H. Waring has been in charge since 1914, but is joining the Government service. C. A. Rice takes his place as superintendent. The new owner is head of the Athletic Mining & Smelting Co., with mines near Joplin and Picher, and a smelter at Fort Smith, Arkansas. The Mutual is well equipped and profitable.

NEVADA

Blair.—The old 17-mile railway from Blair junction to the Pittsburg Silver Peak mine, now closed, is being torn up and sent to Europe.

Goldfield.—Six faces in the Red Hill Florence mine show ore worth from $7.20 to $67.45 per ton, across 18 to 36 in. Awaiting shipment is 165 tons of $35 ore and 500 tons of $6 ore.

The local School of Mines re-opened on September 3, in charge of C. E. Hofmann.

Manhattan.—The White Caps mill is treating 110 tons of ore daily. The shaft is being sunk 125 ft. There is little of importance to record underground.

On the 300-ft. level of the Manhattan Consolidated two good shoots are being opened.

The 700-ft. level of the Union Amalgamated shows 8 ft. of milling ore. W. G. Merton is now in charge.

Some placer mining is still going on in Manhattan gulch.

Pioneer.—The Reorganized Pioneer Mines Co., whose mine and mill were closed in December 1916, is starting important development. The main shaft, 415 ft. deep, is to be sunk to water-level, about 800 ft. depth. Drift No. 3 is being extended to get under good ore that was opened some years ago.

Rochester.—No. 10 level of the Rochester Mines Co. is said still to be opening well. No. 11 is also developing well. The average daily output in August was 181 tons of $13 ore.

On September 2 the Nevada Packard paid a dividend of 2½c. per share. This amounts to $29,115.

OKLAHOMA

Picher.—Production of the districts last week was 4059 tons of blende and 747 tons of lead, valued at $275,119.

UTAH

Bingham.—Upper Main street was burned on September 3, the damage being considerable.

Lark.—The Ohio Copper Co.'s July output was 454,697 lb., almost up to the average of the two previous months.

Tintic.—This district produced 35,000 tons of ore during August, an increase of about 5000 tons, when compared with July. The leading mines in order were the Dragon, Chief Con., Eagle & Blue Bell, Iron Blossom, Tintic Standard, Centennial Eureka, Grand Central, Colorado Con., Mammoth, Gemini, Gold Chain, and Ridge & Valley.

Sixty men are employed by lessees in the Iron Blossom. The company is mining on the 900, 1000, 1100, and 1200-ft. levels of No. 3 workings.

The Colorado Consolidated has $7000 on hand. Royalty from lessees is the principal source of revenue. A large Ingersoll-Rand compressor is to be added to the present plant, which supplies air for all of the Knight properties.

WASHINGTON

Northport.—The Electric Point company distributed $23,790, equal to 3c. per share, on August 31. The daily output of lead ore is now 50 tons. The aerial tram is expected to be finished in September.

CANADA

Bonnington Falls.—The West Kootenay Power & Light Co., a subsidiary of the Consolidated Mining & Smelting Co., having a power-plant here, is making good progress in constructing power-lines to the Canada Copper Corporation's works near Princeton and the smelter at Northport, Washington. From Greenwood, where the Canada Copper smelter is, to Copper Mountain, the situation of the mine, is 100 miles. The transmission-line will carry 100,000 volts. The Northport line will transmit 60,000 volts.

Britannia.—The report of the Howe Sound Co. for 1917, which has copper mines and plant at Britannia Beach, Howe Sound, also lead-silver mines in the Santa Eulalia district, Chihuahua, Mexico, includes the following data:

Smelter returns from copper, lead, silver, and zinc, and

sundries, amounted to $7,114,433. Operations cost $4,574,306, leaving a profit of $2,540,128. Current assets are $2,036,240, and liabilities $457,451. The total development footage in the four British Columbia mines was 32,044. Ore-reserves are estimated at 7,426,080 tons, averaging 1.98% copper. To prospect the Goldsmith claims, an 8 by 10-ft. tunnel was started and driven 399 ft. The 9 by 13-ft. tunnel, known as the 2700-ft. level, was advanced 2172 ft., making it 3603 ft. at the end of 1917. The 3100-ft. tunnel was not extended beyond the 635-ft. point, but an 8 by 8-ft. drift was put in east 367 ft. This is for the raise between the 4100 and 2700-ft. levels, to reduce haulage charges. The 4100-ft. tunnel, the portal of which is 250 ft. east of the new mill at Beach, was advanced 807 ft., making it 2485 ft. long. Four storage-battery locomotives were added to the four already in satisfactory operation. Two more water-driven compressors were installed. A trolley locomotive was obtained for haulage on the tunnel-to-incline system.

At the Mexican properties 4401 ft. of work was done. General underground conditions are excellent, but the general situation was not satisfactory. There was shipped 70,553 tons of lead carbonate, lead sulphide, and iron sulphide ores, carrying from 18.83 to 53.41 oz. silver and 7.18 to 10.20% lead.

At Britannia Beach 671,990 tons of ore was dressed. Shipments to smelter—57,217 tons—averaged 14.29% copper, 0.0173 oz. gold, 1.6 oz. silver, and 3.13% zinc; and contained 16,357,329 lb. copper, 992 oz. gold, and 91,504 oz. silver.

The Utopia and Park Lane dams were strengthened and completed. A tunnel was driven to tap Mountain lake, a natural reservoir. The South Valley power scheme was completed, and is now driving most of the Beach power-house. At this plant there was erected a 2500-kva. generator and two 48-in. Pelton wheels, also two similar wheels as an auxiliary on a 2500-kva. generator already at work. The South Valley project cost $508,644 to the end of 1917.

Kaslo.—Assays have been received from the Mines Branch at Ottawa on several samples of manganese ore sent from Kaslo. No. 1 contains 51.45% Mn, 6.17% Fe, and 7.32% SiO_2; No. 2—52.42% Mn, 5.22% Fe, and 7.30% SiO_2; and No. 3—59.97% Mn, 0.88% Fe, and 2.30% SiO_2.

Surf Inlet.—On the 430-ft. level of the Belmont Surf Inlet mine, on Princess Royal island, the vein is 30 ft. wide in the north drift, of good grade. Development generally is satisfactory.

Trail.—The Consolidated Mining & Smelting Co. pays a quarterly dividend of 2½% on October 1. This is equal to $261,936.

Vancouver.—At the Dominion Assay Office here a refinery is practically complete for gold and platinum; $105 per ounce is to be paid for the latter metal.

Ontario

Cobalt.—The McKinley-Darragh-Savage pays a dividend of 3% on October 1. This is equal to $67,431, making $269,724 for 1918, and $5,349,607 to date.

The Mining Corporation of Canada pays 18¾ cents per share on September 16, equal to $311,259. The total paid by this company and those that it absorbed is $5,594,838.

Gowganda.—Mine operators here express dissatisfaction over the slow progress and poor work being done by the Government on the road to this district.

MEXICO

Chihuahua

Chihuahua.—A number of manganese claims have been staked near this city, and some shipments have been sent to the United States by way of El Paso.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

A. N. Mackay, of Colombia, is in Surrey, England.

Charles Fitch, of Yerington, Nevada, is here on a visit.

Eugene P. Kennedy is on his way to the Kenai peninsula, Alaska.

Richard A. Snell has moved from San Francisco to McGill, Nevada.

John H. Tate, of Jerome, Arizona, was in San Francisco last week.

M. J. Frumken, of Salt Lake City, was in San Francisco this week.

Andrew C. Lawson has returned from Bingham to Berkeley.

J. Morgan Clements sailed from San Francisco for Japan on September 7.

Walter Harvey Weed has been examining a lead-zinc property in Quebec.

H. H. Phelps, of Joplin, Missouri, is at the Whitcomb hotel, San Francisco.

Robert N. Bell, State Inspector of Mines, has been studying mine ventilation at Butte.

G. M. Swindell, of the Los Angeles Chamber of Mines and Oil, was at the Palace hotel last week.

H. C. Bellinger, general manager for the Chile Exploration Co. (at Chuquicamata) is at New York.

L. F. S. Holland has returned from Colorado to Los Angeles. He expects to go to Mexico shortly.

R. G. Hall, new manager of the Burma Mines, sailed for Rangoon from San Francisco on September 14.

N. H. Emmons 2nd is Operations Director of the Government's nitrate plant at Muscle Shoals, Alabama.

Ralph Stokes, now Lieutenant-Colonel in the Royal Engineers, is with the Kola Peninsula Expedition, in northern Russia.

Eugene L. Steindler has moved his office as general manager for the Dominion Reduction Co., from Cobalt, Ontario, to 42 Broadway, New York.

Arthur Feust, consulting engineer to the Peregrina and other subsidiary enterprises of the Guanajuato Development Co. in Mexico, has returned to New York.

Oscar Lachmund has resigned his position as general manager for the Canada Copper Corporation at Princeton, B. C. He is succeeded by **H. R. Van Wagenen** of Denver.

J. G. Souther, superintendent of the Estabrook Gold Dredging Co., has resigned to join the Engineer Corps of the Army. He is succeeded by **J. M. Miles** of San Francisco.

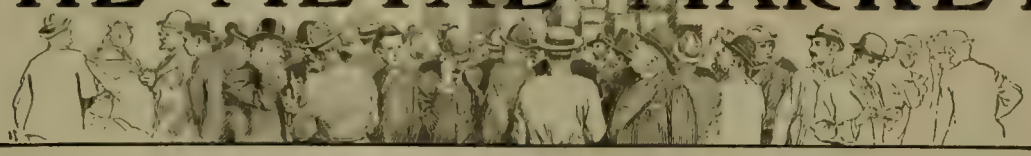
John D. Ryan has resigned as president of the Anaconda Copper Mining Co., to devote all his time to the direction of the Air Service. He is succeeded by the vice-president, **C. F. Kelley.**

N. Bruce MacKelvie died at Sands Point, Long Island, N. Y., on August 17, at the early age of 39. He was president of the Butte & Superior Mining Co., and was identified with the mining activities of Hayden, Stone & Company.

The fourth National Exposition of Chemical Industries opens at the Grand Central Palace, New York, on September 23.

An Oklahoma-Kansas-Missouri Zinc Institute is to be organized, to become a branch of the American Zinc Institute. Victor Rakowsky is chairman. The nominating committee consists of P. B. Butler and F. C. Wallower of Joplin, and R. J. Tuthill of Maine.

THE METAL MARKET



METAL PRICES

San Francisco, September 10

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	16
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	12
Zinc-dust, cents per pound	17½

ORE PRICES

September 10

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$25

EASTERN METAL MARKET

(By wire from New York)

September 10.—Copper is quiet. Lead is unchanged and under strict control. Spelter is inactive, though firm.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

	New York,	London.
Sept. 4	101.12	48.81
" 5	101.12	48.81
" 6	101.12	48.81
" 7	101.12	48.81
" 8 Sunday		
" 9	101.12	48.81
" 10	101.12	48.81

Average week ending	
July 30	99.62
Aug. 6	99.62
" 13	99.62
" 20	100.25
" 27	101.12
Sept. 3	101.12
" 10	101.12

Monthly averages

	1916	1917	1918
Jan.	56.76	75.14	88.72
Feb.	56.74	77.54	85.79
Mch.	57.89	74.13	88.11
Apr.	64.37	72.51	95.35
May	74.27	74.61	99.50
June	65.04	76.44	99.50
July	63.06	78.92	99.62
Aug.	66.07	85.40	100.31
Sept.	68.51	100.73	....
Oct.	67.86	87.38	....
Nov.	71.60	85.97	....
Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date	
Sept. 4	26.00
" 5	26.00
" 6	26.00
" 7	26.00
" 8 Sunday	
" 9	26.00
" 10	26.00

Average week ending	
July 30	26.00
Aug. 6	26.00
" 13	26.00
" 20	26.00
" 27	26.00
Sept. 3	26.00
" 10	26.00

Monthly averages

	1916	1917	1918
Jan.	24.30	29.53	23.50
Feb.	26.62	34.57	23.50
Mch.	26.65	36.00	23.50
Apr.	28.02	33.16	23.50
May	29.02	31.69	23.50
June	27.47	32.57	23.50
July	25.66	29.67	26.00
Aug.	27.03	27.42	26.00
Sept.	28.28	25.11	....
Oct.	28.50	23.50	....
Nov.	31.95	23.50	....
Dec.	32.89	23.50	....

Copper-refining charges, including freight, are now up to $35 per ton of metal. The average cost in normal times was $12. Some refiners claim that it costs them $27. A ton of copper is worth $520, so that the refining charge is nearly 7%.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
Sept. 4	9.37
" 5	9.37
" 6	9.37
" 7	9.37
" Sunday	
" 9	9.50
" 10	9.50

Average week ending	
July 30	8.45
Aug. 6	8.37
" 13	8.37
" 20	8.60
" 27	9.16
Sept. 3	9.42
" 10	9.41

Monthly averages

	1916	1917	1918
Jan.	18.21	9.75	7.87
Feb.	19.99	10.45	7.97
Mch.	18.40	10.78	7.67
Apr.	18.62	10.20	7.04
May	16.01	9.41	7.29
June	12.85	9.63	7.92
July	9.90	8.98	8.72
Aug.	9.03	8.58	8.87
Sept.	9.18	8.33	....
Oct.	9.92	8.32	....
Nov.	11.81	7.76	....
Dec.	11.26	7.84	....

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date	
Sept. 4	8.05
" 5	8.05
" 6	8.05
" 7	8.05
" 8 Sunday	
" 9	8.05
" 10	8.05

Average week ending	
July 30	8.05
Aug. 6	8.05
" 13	8.05
" 20	8.05
" 27	8.05
Sept. 3	8.05
" 10	8.05

Monthly averages

	1916	1917	1918
Jan.	5.95	7.64	6.85
Feb.	6.23	9.10	7.07
Mch.	7.26	10.07	7.26
Apr.	7.70	9.38	6.99
May	7.38	10.29	6.88
June	6.88	11.74	7.58
July	6.40	10.93	8.03
Aug.	6.28	10.75	8.05
Sept.	6.86	9.07	....
Oct.	7.02	6.97	....
Nov.	7.07	6.38	....
Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date	
Aug. 13	120.00
" 20	120.00
Aug. 27	120.00
Sept. 3	120.00
" 10	120.00

Monthly averages

	1916	1917	1918
Jan.	222.00	81.00	128.06
Feb.	295.00	126.25	118.00
Mch.	219.00	113.75	112.00
Apr.	141.60	114.50	115.00
May	90.00	104.00	110.00
June	74.70	85.50	112.00
July	81.20	102.00	120.00
Aug.	74.50	115.00	120.00
Sept.	75.00	112.00	....
Oct.	78.20	102.00	....
Nov.	79.50	102.50	....
Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal.

Monthly averages

	1916	1917	1918
Jan.	41.76	44.10	85.13
Feb.	42.60	51.47	85.00
Mch.	50.50	54.27	85.00
Apr.	51.49	55.83	88.53
May	49.10	63.21	100.01
June	42.07	61.93	91.00
July	38.37	62.60	93.00
Aug.	38.38	62.53	91.33
Sept.	36.66	61.54	....
Oct.	41.10	62.24	....
Nov.	44.12	74.18	....
Dec.	42.55	85.00	....

Tin, tin-plate, and terne-plate regulations have been issued by the War Trade Board. They cover the export of these products.

Tin exports from Hongkong to Pacific ports during the first half of 1918 totaled 7491 tons, against 4556 tons in 1917, and 2641 tons in 1916.

The Vulcan Detinning Co., which recovers tin from scrap, reports sales amounting to $429,161 for the second quarter of 1918. The net profit was $45,999. The previous period's figures were $288,996 and $49,245, respectively.

ORES (New York)

Antimony: There have been no developments and no market in this district.

Ferro-manganese: There has been a slight change in the quotation for 70% alloy. Sales are now being made for delivery this and next month at $250, delivered, for 70% alloy, plus or minus $3.50 per unit above or below this standard, instead of $4 formerly. This has been brought about by the frequent offerings of one producer in recent weeks; but the new basis is really also nearer the true value of the manganese content on the $250 for 70% alloy basis.

Molybdenum: The market is quiet and nominal at $1 per pound.

Tungsten: There is little to be said beyond that reported in previous letters. The market is moderately active, with high-grade ore selling at $24 to $25.50 per unit, and the lower grades selling down to $20. Ferro-tungsten is quiet at $2.35 to $2.45 per pound.

Eastern Metal Market

New York, September 4.

The markets all continued to be quiet but firm, with a strong tone. Price changes, where unregulated, are small.

Enough copper to meet all demands is the chief concern of this market.

Tin continues to decline slowly, but the market is lifeless.

Lead is as scarce as ever, with no prospect of any relief. Prices continue regulated by agreement.

Zinc is less active and is slightly easier as a consequence; but the tone is firm.

Antimony is a little lower on lighter demand.

The August pig-iron output was less than that of July, as expected, due to the heat and humidity. The rate of output was less than that of April, May, and June, but was higher than any other month since May 1917. The total was 3,389,585 tons, or 109,341 tons per day, against 3,420,988 tons in July or 110,354 tons per day, a falling-off of 100 tons in the daily rate. There were nine more furnaces in blast on September 1 than on August 1, and the output should be higher from now on with improved weather conditions. At a meeting of iron and steel-makers in New York on August 28 the labor problem was the sole topic. Not even the question of prices for the last quarter was touched upon. The conference on prices with the War Industries Board will be held on September 18 at Washington. The establishing of a rail price will be left open until that meeting. The Board has ordered an inventory of the country's stocks of finished iron and steel.

COPPER

The labor situation is not what it should be, when full capacity of copper, especially crude copper, is considered. It is causing some concern, particularly to producers, that this is not as large as it should be at Western smelters; the cause is evidently lack of labor. With demand and consumption on the increase almost daily, the need of all the raw metal possible is self-evident. Refinery output is much more auspicious, the monthly average so far this year being estimated at 200,000,000 lb., compared with 205,000,000 lb. per month in 1917. The supply for domestic consumption, however, is aided or supplemented by the fact that exports in 1918 have been much less than in 1917 by almost 30%. The suggestion that the railroads of the United States be electrified at some time in the near future means the consumption of an enormous amount of copper, as does also the development of the water-power of the country. It is interesting to note that the Imperial Munitions Board of Canada reports that so far, 10,000 tons of copper, valued at $5,000,000 has been re-melted and cast with ingots from turnings left in making copper lining-bands for shells for the British Ministry of Munitions. There has been less contracting lately for delivery while the present 26c. price rules, or until November 1. Buying for delivery beyond that date, while small, is at the prices ruling in that period. Jobbing lots, less than 5 tons, are selling at 27.35c. per pound.

It is stated that the increasing demand for copper for war purposes is growing beyond the scope expected by producers and consumers three months ago. It is estimated now that less than 3% of the current output of the country's refineries is going into manufacturing, not in connection with the War. Only a few weeks ago men concerned with the distribution of the metal calculated that 5% was available for commercial purposes in the United States and abroad.

TIN

The only event of the past week has been talk, and only talk, of price-fixing by the Government. An investigation shows no ground for this. Importers would have been notified first, were it a fact; but any regulation would have to be co-operative between the United States and the British governments. A price of 76.50c. per lb. was rumored, but whether with New York as a basis or the Far East was not divulged. The general situation is as quiet as ever, with no sales at all for any position reported. Prices are gradually falling on shipments from the East, and even the nominal spot price is also lower. This is now 83c. per lb., New York, against 88c. a week ago. with the supply still small. For shipments from the Far East probably 76.25c. could be done. Underlying conditions are fundamentally unchanged, buyers remaining uninterested pending results of the important London conferences of American and British tin interests, concerning which no news has yet been made public. Arrivals for August, to the 24th inclusive, were 3535 tons, and those at Atlantic ports 2500 tons to the 29th, inclusive. Spot Straits in London was again lower at £353 10s. per ton yesterday, compared with £367 10s. per ton a week ago.

LEAD

There is very little to be said beyond what has been during the last few weeks. Scarcity of the metal is the pronounced feature, and there is little prospect of this being relieved for some time. In fact, in the opinion of one dealer this may get worse before it improves. The market in the meantime is drifting here and there, with prices at a fixed level as agreed upon by leading producers, namely, 7.75c., St. Louis, or 8.50c., New York, for carload and larger lots and 8.55c., New York, for less. The lead situation is closely analagous to that of copper—producers' committees closely regulating sales and distribution, the main difference being that in the case of lead the committee is voluntary and not a Government body at all.

ZINC

The market is slightly easier than last week on lighter demand and fewer transactions. It is at present on nearly a nominal basis, interest having died out after the fairly large buying of the last 10 days or two weeks. Sellers are apparently well sold up for September and into October, for which the quotation now is nominal at 9.12½ to 9.25c., St. Louis, or 9.37½ to 9.50c., New York. For the fourth quarter the market seems fairly firm at 9c., St. Louis, or 9.25c., New York. For spot delivery it is hardly likely that any better than 9.25c., St. Louis, could be done. A sale for fourth quarter at 8.85c., St. Louis, has been heard of, but it was regarded as second-class metal and not representative of the market. The output of grade A for the week ended August 24 showed an increase, according to the Government's weekly report, but lower grades showed in the main a decrease. Exports of zinc as slabs, spelter, etc., were 4610 tons in July, with the total to August 1 at 51,085 tons. Sheet-zinc is controlled by a maximum price of 15c. per lb., base, with plate-zinc at 14 cents.

ANTIMONY

There has been a light demand, especially for wholesale lots, and the market has fallen slightly. It is now quoted at 14.12½ to 14.25c. per lb., duty paid, New York, for prompt and early delivery.

ALUMINUM

Government fixed maximum prices are unchanged at 33c. per lb. for 50-ton lots, 33.10c. for 15 to 50-ton lots, 33.20c. for 1 to 15-ton lots for both scrap and No. 1 virgin metal, 98 to 99% pure.

Mining and Scientific Press

Edited by T. A. RICKARD

Volume 117
Number 12

SAN FRANCISCO, SEPTEMBER 21, 1918

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$4 per Year

AN INDEPENDENT PAPER OWNED, EDITED, AND MANAGED BY ENGINEERS

THE NEWPORT MINING COMPANY
MINAHALE
OFFICE OF PURCHASING AGENT

July 23, 1918.

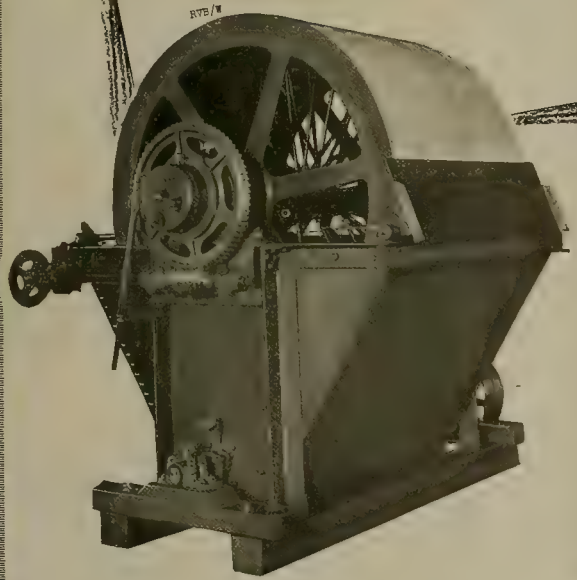
Oliver Continuous Filter Company,
503 Market Street,
San Francisco, California.

Gentlemen:

We have your letter of July 15th. The present extention to our Carrollville plant is being built on a contract between the United States Government and The Newport Mining Company, the Newport Mining Company being the principal owner of the plants of the Newport Hydro Carbon Company and the Newport Chemical Works, Incorporated. The filters are to be installed in Phenol Plant now being erected at Carrollville. The shipment came through in very good time, and, though point of origin is perhaps further away from us than any other item we have had to get for the plant, there is no other one item of equipment with which we encountered any less difficulty in shipment and delivery.

Yours very truly,
THE NEWPORT MINING COMPANY,
By R.V. Brewer
Assistant Purchasing Agent.

RVB/W



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The Development of Flotation at the Broken Hill Proprietary Mine, Australia
Rotterdam, the Distributing Centre for the C. R. B.

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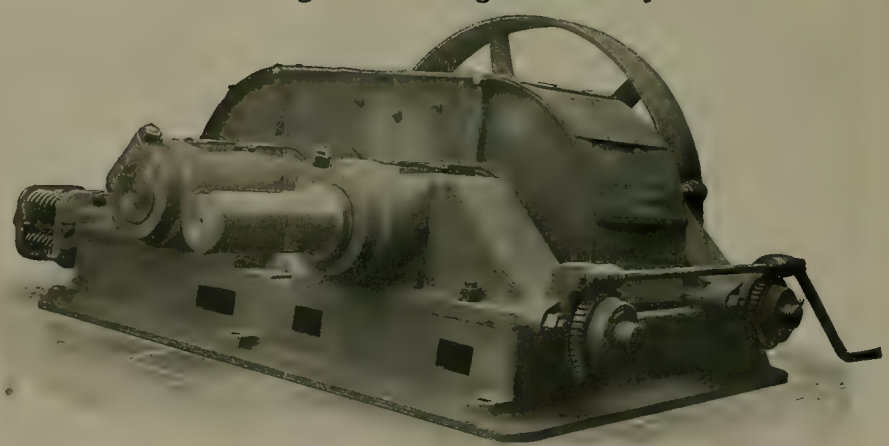

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EDITORIAL STAFF

T. A. RICKARD, Editor
COURTENAY DE KALB, Associate Editor
M. W. von BERNEWITZ, Assistant Editor

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BUSINESS STAFF:

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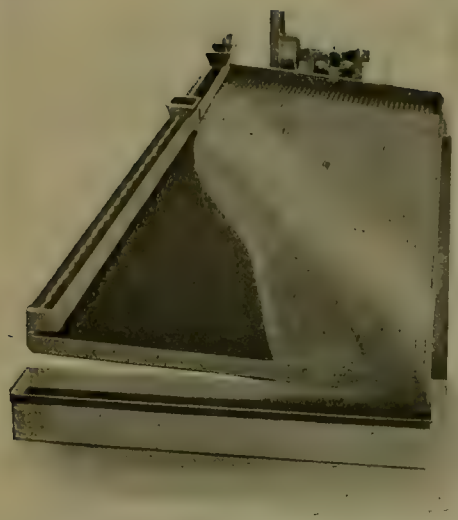

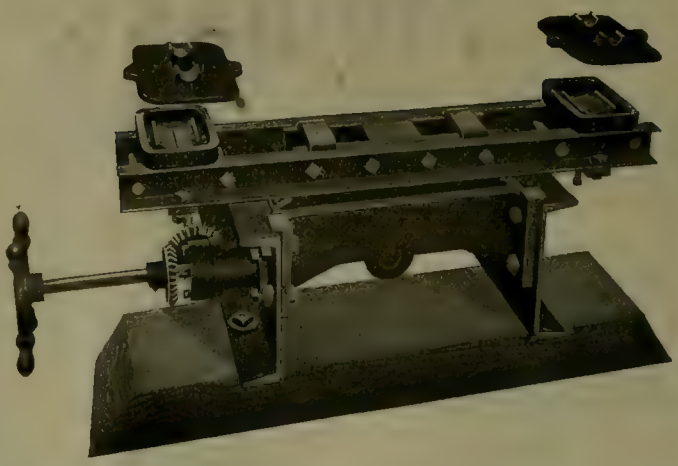

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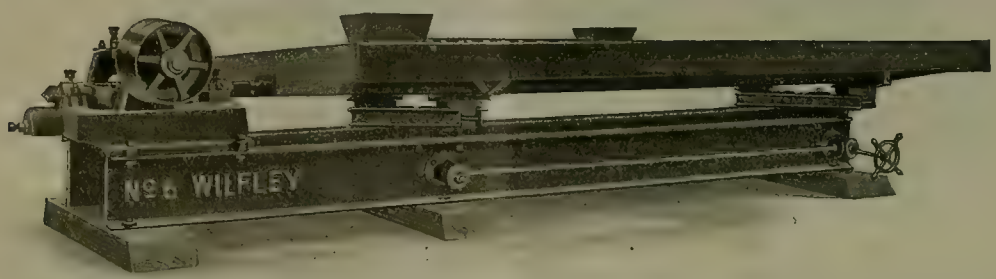


HOW unrepentant the Kaiser and his ministers still are is suggested by the nomination of one of the princes of Hesse to the crown of Finland. They seem not to have realized that kings at best are belated anachronisms and that the Prussian kind of king is intolerable in a world that knows what Willie and Nicky, Joseph and Tino, have done in the way of scheming and bloodshed.

EACH successive issue of Liberty bonds finds the people better prepared to absorb them, because a campaign of education has been in progress almost continuously since the first Liberty loan was launched. The benefit of thrift in behalf of the Cause is being appreciated, both for the good it does to the Nation and to the citizen. At this time, when the American eagle has filled the air with feathers of the discomfited German vulture, it is obvious that no safer security is available for the savings of the careful man, and that the rate of interest is high considering the gilt-edged character of the investment. If that be insufficient inducement, look at the casualty lists and consider how little you, who are safely at home, can do—and how you are in honor bound to do it—in comparison with the supreme sacrifice.

BRASS manufacture has failed to keep pace with the needs of the Government, partly by reason of the shortage of labor, and partly from the continuance of non-essential uses of brass in the arts. A conference of the brass-makers with the War Industries Board has resulted in a decision to restrict the use of the alloy in many industrial branches, and to employ every possible means to increase the output. A re-distribution of Government orders will be made, which incidentally will curtail the ability of the manufacturers to supply private parties. The gross production of brass at present is 2,910,000 pounds per day. It is estimated that the output can be increased to 3,390,000 pounds by administrative improvements in the works, and by obtaining a larger number of laborers through the co-operation of the Government Employment Bureau.

WE are informed that the Colorado meeting of the Institute was a most pleasant affair and was well attended, despite the lack of a reason for such a meeting at this time. The speeches at the banquet are said to have been numerous, and good. The President, Mr. Sidney Jennings, made an eloquent appeal to the women to stand firm against premature talk of peace; the ex-President, Mr. Philip Moore, was welcomed heartily on his return from Alaska; Dr. Ricketts gave an almost lyrical description of a young man's opportunities in the South-West; Mr. Horace Winchell contributed sundry impressions of Russia that were not lacking in the sardonic humor that the miserable plight of that befooled people invited; Mr. Mathewson was in excellent form, and Mr. Tom Stearns told a story that made a lasting impression on the ladies.

LEST we forget, let us recall what the Germans did at Lille during Holy Week in 1916. They invited the inhabitants of that French industrial centre to raise crops for them, the invaders, and when the Lillois refused they seized 20,000 of them and compelled them to labor, strong and frail, boys and girls, any that were more than 15 years of age, in their own fields, to gather crops while under guard of soldiers armed with guns and fixed bayonets. Think of that slave-driver in his field-gray uniform as he bullied groups of women just behind the line of battle where their husbands were fighting for their homes. That was 'frightfulness,' the fine flower of kultur. It was the Bavarians under Prince Ruprecht that did this shameless thing, for the Prussians have found other Germans fully capable of following their lead. The yellow streak runs through the German character and the War has developed it as with hyposulphite. When the day arrives for settling the account, do not forget the deportations at Lille.

GERMANY'S moral bankruptcy has been completed by the revelations made at Washington by the Committee on Public Information. This extraordinarily detailed exposure of base intrigue on the part of the German government and the unmasking of the treachery of the German-Jew anarchists that posed as Russian Socialists comes at a moment when the First American Army has scored a clean-cut and complete success at St. Mihiel, proving that the Intelligence Department and the Army are co-operating in the discomfiture of the pirate crew at Berlin. They stand outlawed by every code, human or divine, the meanest, savagest, stupidest gang of conspira-

tors that ever attempted to undermine civilization. The exposure, when it becomes known in Germany, must knock down the last under-pinning of confidence that the German people may yet retain in their leaders, military or diplomatic. The stupidity with which the despoilers of Russia allowed the evidences of their intrigue to be multiplied in written documents and the skill with which Mr. Edgar Sisson collected and pieced together all the proofs in the case, expose again the futility of the German spy system and deride the conceit of the barbarians that set out to impose their ways of thinking and living upon a prostrate world.

ON August 30 the United States Mints and Assay Offices received instructions from Washington to cease selling gold to individuals for industrial purposes. This order was provoked by the steady increase in the demand from jewelers, dentists, and makers of optical goods. It was noted that, during the fiscal year ending June 30 last, gold to the amount of $55,000,000 had been withdrawn from our national reserve, ostensibly for use in the arts. The Government officials feared that this bullion in part was being hoarded, and the privilege of further purchase accordingly was denied. A universal protest from the affected industries instantly arose, and it was evident that an open market for new gold at an advanced price would be created unless the ruling were modified. Therefore, a supplementary order was issued on September 6, permitting the purchase of gold from the Government at the standard rate per ounce, but under regulations that ensure its consumption in certain specified essential industries. This episode has an important bearing on the proposals recently made by the American Gold Conference and other organizations toward obtaining financial aid for the producers of new gold. It reveals the anxiety of the Treasury Department to increase the gold-reserve, and it accentuates the need of a stimulus to gold mining in order to provide the metal needed for industrial as well as for monetary uses.

GERMANY'S defeat is made evident, not only by the retreat of the invaders in France, and by the verbal inexactitudes of the reports issued at Berlin, with their pitiful attempts to obscure the facts, but by the speeches of her leaders, the Kaiser, the Chancellor, and the Vice-Chancellor. They are whining and they are lying in a panicky effort to reassure a panic-stricken people, at last beginning to realize how they have been deceived, exploited, and misled. Not even the record of men and guns captured from the Enemy tells the story of his defeat so plainly as the text of the Kaiser's speech at Essen. It is a remarkable example of the German way of imputing to others their own ideas and of disclaiming bad intentions as soon as those intentions have been thwarted. The paranoiac Kaiser asserts that it was the English who "introduced terrible hatred into this War" and that he "left no stone unturned to shorten it"—yes, by falling upon his neighbors when he thought them unprepared for his attack. Now comes the Austrian overture for a conference, hastened by the dissensions among the various racial units in the unhappy political partnership that goes by the name of the Austrian empire. There should be no discussion with the Central Powers until they have withdrawn from Belgium and France; the only conversation required at this time is two words: evacuation and restoration—of the countries they have invaded and marauded.

APROPOS of the restriction upon the use of hydro-electric power that has been found necessary in California, it is worth while to note that the estimated potential energy available in the State is 8,865,000 hp., and that only 8.2% of this, or 722,125 hp., has been developed. Oregon has a possible 7,505,000 hp., of which no more than 2.1% has been made available at the switchboard. Cheap abundant power is one of the greatest sources of wealth and a potent stimulus to industry. The New England States have utilized 47.1% of their natural power resources, and Michigan has brought into service 64.2% of its potential hydro-electric energy. It has been suggested that one of the most useful enterprises of the Government at the close of the War would be to employ a part of the technical talent and skilled labor of the returning Army in the construction of plants for developing this latent energy for the expansion of industry. That it would ameliorate economic conditions is indubitable. It would also demand large amounts of copper and other metals, which would tend to relieve the difficulties of the miners. The project is closely related to the electrification of the railroads, which, according to a recent statement by Director W. G. McAdoo, has become imperative. He declares that it may be necessary to undertake it even while the War is in progress, as a means for relieving the shortage of coal. The problem will be attacked first at the points where the static value of the available water is greatest, that is, in the mountainous districts of the West and South. Also electrification will be adopted as a means for simplifying the handling of freight at terminals. The economy of labor in operating that would ensue upon making such changes is regarded as offering advantages sufficient to compensate for the temporarily increased demand for labor involved in manufacturing and erecting the equipment.

BY courtesy of the Commission for Relief in Belgium we are enabled to publish an article by Mr. Walter Lyman Brown describing the distribution of supplies imported at Rotterdam, which is the chief distributing centre for the C. R. B., as it is generally called. Like the other members of the Commission, Mr. Brown is himself a mining engineer not without honor in his own country. We are informed, by headquarters, that he "has had a hard job" and deserves much credit for the excellent manner and spirit in which he has conducted his arduous duties. Before the negotiations with the Netherlands government were completed, the Commission had a great deal of trouble with the Dutch people while passing supplies for Belgium through Holland, owing to

the shortage of food in Holland itself. There were riots on the docks, and attacks on the American government appeared in the Dutch newspapers, a result by no means astonishing if it be remembered that the people of Holland were short of food and had to pay fabulous prices for the most ordinary commodities, while watching the transfer of 60,000 to 70,000 tons of supplies through their own ports to Belguim. Mr. Brown faced these unpleasant conditions manfully and overcame them in due course by the manifest sincerity of his efforts. His assistant for some time has been Mr. A. C. B. Fletcher, of California. Not only has food been supplied to the Belgians, but clothing and shoes as well. Gifts of clothing, so Mr. Brown informs us, have been received from all over the world, and in this benefaction California has been conspicuous, thanks to the good work done by the Californian Committee and Mrs. Vernon Kellogg. When the parcels arrive they have to be opened and searched for papers or letters, in order to prevent trouble with the Germans. This removal of letters is done regretfully, because many of them, accompanying gifts from American to Belgian children, are most touching and would gladden the hearts of the recipients. About 2,000,000 garments have been distributed in this way and they continue to arrive in increasing quantity, besides the purchases for the same purpose made by the Commission itself, amounting to 15,000,000 yards of cloth, 3,000,000 pieces, and 540,000 pairs of shoes. Nevertheless, as Mr. Brown takes pains to suggest, the need for more is pressing, owing to the complete exhaustion of stocks in the country, "so that now, as for food, the nine million Belgians rely almost entirely on the all too small amounts that the C. R. B. can ship." We quote this message in the hope that it may stimulate further gifts. If there is one thing more than another of which the United States may be proud it is not the money subscribed to the Commission, for the subscriptions have been relatively small, but the executive ability and fine spirit contributed by a group of American mining engineers to the work of the Commission in Belgium.

The Iron of Lorraine

An American General of Alsatian origin has achieved a complete victory in French Lorraine. In truth, General Pershing and his troops have started the liberation of a part of France that is of the utmost value, not only in sentiment, but industrially, for in the department of Meurthe-et-Moselle, historically a part of Lorraine, are the great deposits of iron ore essential to the life of French industry. The American troops, after erasing the salient established by the Germans four years ago at St. Mihiel, are approaching Briey, which is at the southern end of the Longwy-Briey iron district. Another less important portion of the Lorraine iron deposits is centred at Nancy, which the Germans have tried repeatedly to win. The tremendous effort made to capture Verdun was prompted, in large part, by the Enemy's desire to obtain a firm grip on the iron resources of France, for not only did the holding of Verdun protect Nancy but it interfered with the German exploitation of the iron ore at Briey, where in 1912 four mines produced 5,600,000 tons of ore, equivalent to about a third of the French production in that year. From the citadel at Verdun, the French have been able to see, at night, the flare of the blast-furnaces in which the invaders have been smelting the ore and obtaining the iron for use in killing the rightful owners of the mines. These metallurgical operations, needless to say, have not been uninterrupted by the French artillery. The cathedral of Rheims has been battered by shells made from iron mined in France. Great is the importunity for driving the despoilers from Lorraine. It is said that, when Bismarck was imposing terms upon France after Sedan, he was advised of the importance of the mineral resources of Lorraine by a

MAP OF THE WESTERN BATTLE-AREA, SHOWING THE IRON DEPOSITS OF LORRAINE AND THE COALFIELDS OF FRANCE, BELGIUM, AND WESTPHALIA. THE FIGHTING-LINE IS NOT MARKED BECAUSE IT CHANGES SO RAPIDLY FROM DAY TO DAY.

German geologist. If that be true, then the German geologist made an egregious blunder, for he mapped the ore-zone incorrectly, otherwise all of it would have been included in the territory seized from France in 1871. Indeed, the recovery of Alsace and Lorraine means more to France than appears on the surface. The return of the people and the soil of the lost provinces is the recognized prize of victory to France, but underneath the surface is a great industrial treasure, the famous deposit of 'minette,' an iron ore that is comparatively low-grade, averaging only 35%, but existing in a deposit so big and so shallow that it can be mined cheaply. The ore-zone is 8 miles wide, 40 miles long, and as much as 60 feet thick. In 1913 the Longwy-Briey basin yielded 15,147,000 tons of the total French production of 21,700,000 tons. In the same year the part of Lorraine taken from France in 1871 gave the Enemy 21,136,000 tons out of her total production of 28,600,000 tons. The deposits extend also into Luxemburg, which, in 1913, produced 7,333,000 tons, making a total of 43,616,000 tons mined in this region as a whole, the equivalent of 13,800,000 tons of iron. When the lost provinces are regained, the French production of

iron ore will increase to 43,000,000 tons, while that of Germany will decline to 7,500,000 tons. Before the War, according to the statistics of 1912, there was exported 4,673,000 tons of 'minette' ore to Belgium and 2,798,000 to Germany. The scarcity of coking-coal, needed for smelting the iron ore, compelled this exportation, in return for imports of coal from German Westphalia and from Belgium. The output of the Valenciennes coal-field is not as suitable for smelting the ore. Hence in time of peace there was a mutual exchange of raw materials between France, Germany, Belgium, and Luxemburg, a friendly co-operation of which the Germans took advantage in order to obtain the information that they needed for their predatory campaign. It is no wonder that a German writer, Dr. J. Reichert, of Berlin, in an article appearing in the December 1917 issue of the 'Weltwirtschaft,' explains: "The occupation and exploitation of the Briey-Longwy deposits saved us in this War. We live and breathe because we are able to defend our country and our life with the iron of Lorraine"; to which a French commentator, M. Henri Hauser, probably of Alsatian origin, now of the University of Dijon, replies: "Briey and Longwy—this is for Germany the means of re-making her fortune when peace is restored; this also is the means for preparing for—or not having to fear—the next war. That is why M. de Schoen, in 1914, was told to demand Toul and Verdun from us. That is why the Crown Prince hurled his army against Souville and Douaumont. That is why Germany will defend Briey to the very end." And, shall we not add, that is why the American army under Pershing will continue to crumple the German lines until the invaders are driven from the blast-furnaces at Briey, when their fires, re-lighted by French hands, shall flare in the night like the dawn of a new day, when the soil of Lorraine and all that lies beneath shall be delivered from the hands of the despoiler, and returned, with joyous acclaim, to our gallant Ally. *Chaque homme a deux patries, la sienne et la France!*

The New Slav Countries

Political geography is a subject to which the average American paid but little attention in those far-off days before Armageddon, for he was sufficiently occupied with the development of his own continental area and the relations between the States in the Federal union. To the mining engineer, however, some knowledge of world-wide geography was vouchsafed if only because he traveled across the seven seas to distant lands in the performance of his professional duties. Of late, thanks to the War, which is a stern educator in many other ways, he has had to learn more about political boundaries than he ever thought it necessary in years gone-by. The romantic emergence of the Czecho-Slovak armies in Russia and the recent recognition of a Czecho-Slovak state by the governments of the United States, Great Britain, France, and Italy has provoked interest in racial and political facts heretofore outside the ken of the average well-informed man. Not only has a Czecho-Slovak state been formally recognized by the principal Allies, but another political entity, Jugo-Slavia, is receiving sympathetic consideration, among others from Italy, the country that might seem to have good reason to resent the creation of such a state. Thus two new countries are being placed tentatively on the map by the student of European politics, the first to include Bohemia, Moravia, and a part of northern Hungary, these three contiguous regions being inhabited by Czecho-Slovaks; the second to include Serbia, Montenegro, Bosnia, Herzegovina, Dalmatia, Croatia, and a part of southern Hungary, that is, a consolidation of regions inhabited by the Southern Slavs, the word Jugo being Serbian for 'south.' Czecho-Slovakia will be separated from Jugo-Slavia by the valley of the Danube and central Austria. These events threaten to add new complications to the settlement of international relations at the end of the War; they involve the Allies in fresh responsibilities toward the struggling nationalities in Europe, but both the complications and the responsibilities will be faced frankly and sincerely because they form an essential part of the readjustment made necessary by the outbreak of Prussian barbarism. The creation of these new States involves the disintegration of the ramshackle empire that took the first step in bringing this cruel war upon the world and it likewise involves a frustration of the German purpose to exercise suzerainty over Austria-Hungary as a part of the policy that was to create a Mittel-Europa under the aegis of the Hohenzollern dynasty. Austria-Hungary has been stewing in the juice of internal racial dissensions for a long time, in the expectation—at Berlin—that when the morsel became sufficiently tender it could be assimilated by Germany without the least symptom of political dyspepsia. That pleasant little repast is indefinitely postponed and instead of it there has been given a chance for freedom to sundry isolated and politically exiled peoples that have too long suffered the domination of the Hapsburgs and Hohenzollerns. There is going to be a slump in kings when this war is over. Another rectification must follow the creation of the two Slav countries, and that is the resuscitation of Poland, not as a kingdom, but as a separate country, and not as an appanage of Germany, Austria, or Russia, but as a free people. Again we must turn to the political atlas in order to realize how much such an idea involves: not only the Russian Poland that we knew before the War, but also Galicia, or Austrian Poland, and the old German Poland that included parts of Silesia and of Posen from the borders of Galicia down the Vistula to the Baltic coast at Danzig, making altogether a territory equal to about one-third of Germany or of France, these being nearly equal in area. Such readjustments will put an end to Prussianism, and in them the Germans will feel the sting of defeat; nay more, in the creation of these buffer States, not political abortions, but real entities based upon racial and linguistic harmonies, will be found the best insurance against a repetition of the nightmare of horror that has been brought upon the world by the arrogant ambition of the Kaiser and the deliberate design of his misguided people.

War-Minerals Bill

The Editor:

Sir—During the past six months, I have read carefully many articles that have appeared from time to time, in your magazine, and I have failed to note one word favorable to the consumer.

It would seem that the object of the Bill was to protect the owner of low-grade mines, not for the present but after the War. If the United States controlled the world's markets of rare minerals, such a move might be recommended, but up to the present, the returns have not shown even a fair proportion.

With prices of tungsten ranging about $90 per unit, and the entire mining community hot after new properties, the returns did not show any great increase. It is true, many small properties were opened up, only to be closed down when prices dropped to $30 per unit. With present prices, three times what they were prior to the War, it was necessary to import into the States more than was produced; something like 5000 tons (long) being imported as against only about 4000 tons (short) of home production.

As the Allies are depending upon the States for large consignments of different rare minerals and alloys, it seems improper to curtail them at this time. It seems equally wrong to establish war prices for the present and to continue after the close of the War.

It is asked that a price be set at about $40 per unit, this being necessary to protect the small producers. Can the consumer or producer of tool-steel stand such a price and meet competition from Germany or Sweden after the War, when they are able to buy tungsten for half the price? It is claimed that a 0.75% ore is better than the average of the home mines. Therefore for such poor veins protection is necessary. Our dumps over here carry over 1%.

It was reported to the War Board committee that the Burmah mines were only asking $12.60 per unit; that a similar price existed in China, or rather c.i.f. prices New York. The facts are: Great Britain established a war price of 60 shillings c.i.f. London for everything from her colonies, prohibiting exports elsewhere. This did not prevent her manufacturers from buying on the open market when supplies ran short. The same with France; high prices were discouraged. Prices were made and set by the governments, therefore it is unfair to consider the prices as normal. This was recently shown when conditions at Hongkong were changed. Great Britain claimed that the tungsten that entered a British port could not be shipped except to England and at the Government price. The Chinese shippers raised an objection, which was seconded by the U. S. government, and the embargo at Hongkong was raised. Since then the Chinese price has been about $19 c.i.f. New York for a product averaging 68%.

Already we have been hit rather hard with restrictions. First graphite, then molybdenite, to be followed by manganese. Unfortunately these restrictions did not reach this part of the world until after the date of expiration. Americans that have cash invested in mines as well as in advances on ores, as they come in preparatory to shipping, were hit hard, but we understand the situation. Not so with the native mine-owners, who immediately come back at us with the query, 'Japan being an Ally, why are minerals necessary for war purposes prohibited, with conservation of space given as an excuse, when such truck as cheap porcelain, etc., taking up thousands of tons annually, is not restricted?' When these parties are left high and dry with cancelled contracts on their hands, they feel that a fair deal has not been given them. It must not be presumed that they will cease doing business, but will we be able to enter into future contracts with them after others have made long future contracts to take effect after the War?

Permit me to touch on several minerals that, as an exporter to the States, have come under the restrictions to date:

TUNGSTEN. In the report given by Mr. Manning, it is stated that there are sufficient mines in the States to produce all that is necessary. No doubt this statement is a fact, if the small veins are made to produce profitably. Again I ask, with a 10% or more tungsten used in special steel products, can our manufacturers produce, export, and meet foreign competition and pay $40 per unit for a 60% product, with the outside market standing at $20 per unit for a 65% product? Is it wise to curtail our exports of steel in order that small mine-owners may be protected? My argument falls flat if competition will not be injured by this difference. Atolia claims to have a mine that carries 0.75%. We control a property that carries nothing but crystal aggregates weighing even over three pounds each, analyses averaging 76%. Korea is at present producing an average of 110 long tons monthly of both scheelite and wolframite—mostly from hand-concentration as well. Bar this product from the States and it will go where it did before the War—to Germany. Have we no fears of competition from that source? If Germany becomes the only buyer, naturally

she will force the price down and take the entire ouput. Is this not something to count on?

As I have repeatedly stated, we can deliver c.i.f. New York for $12 per unit, if forced to do so, and still make a reasonable profit. Is it not therefore better to fix a fair price, establish duty, and give the steel manufacturers a chance?

MOLYBDENITE. Similar conditions exist. The restrictions became known here four days after the expiration date. We had 14 tons on hand. We sold elsewhere, but at a 25% loss. We shipped only flakes, hand-picked, over 90% MoS_2. This product is all going at present to Europe, and at prices far less than those prevailing in the States.

PLATINUM. Evidence was introduced before the War Board to the effect that platinum was necessary during the War and that we had been depending upon Russia for our supply. What has happened? It is now deemed necessary to commandeer all stocks, to cover up the shortage, whereas during the past six months more platinum has been offered for sale here than ever before. It is being brought in by Russian refugees. How can exports to the States be expected when an arbitrary price has been set at $105 per ounce? With exchange at 53⅛ we can dispose of every ounce offered at what would be equal to $108 per ounce right here to buyers for European countries. Just why my Government placed such a low price on an article that is not found at home except in very small quantities I cannot understand. The same applies to iridium.

MANGANESE. Here we have a different condition: one that involves large tonnage. But the native again has his little say: "Why when we worked hard and in good faith to supply your wants, you now refuse deliveries because your country does not want same. If you had given us the opportunity to ship all under way, we would not feel so; but to place orders and then decline to accept, after we had shipped from the mines, is not fair dealing." So it runs, and the future will tell the consequences.

GRAPHITE. A very unfortunate condition. We were hit rather hard because we had no time to catch the first steamer even before the restriction came into effect. Only after extra hard work were the exporters able to secure flake graphite. Cables galore were received asking that shipments be increased; it was required for a blend in making crucibles; capital was invested, and cash had been advanced, only to have everything stopped without a moment's notice and the excuse given that it is necessary to protect the Alabama mine-owners. The present prices have dropped nearly 40% and long forward contracts have been made for shipments to England. Our home prices, we understand, have advanced.

My position, as an American of the fifth generation, is to accept all orders as they are issued. I also feel it my duty to explain conditions as I find them over here. I may be entirely wrong. I am not against the small producer or owner of a low-grade mine; but if we start protecting such properties, why not protect everything in the same ratio?

When mills are erected in Korea and Manchuria, the world will note a new mining centre. But even though labor will be cheap and freights within reason, prices will never be satisfactory under the prevailing market.

Can the mill-owners afford to pay double the market-price for raw materials and compete abroad? Now is the time to consider such points. Already outside interests are at work. Contracts can be made for years to come, and when one knows that the Japanese have nothing against Germany and are at present merely following the dictates of the British alliance, we cannot take issue against Japan, should she feel inclined to deal direct with Germany after the close of the close of the War—not as a nation perhaps, but I doubt whether restrictions will be placed against business dealings with the Germans.

For the period of the War at least, I doubt the merits attached to placing restrictions on war necessities, such as raw materials, when produced by an Ally. Far better to restrict unnecessary articles if the conservation of space is the reason.

GEORGE R. ALLEN.

Seoul, Korea, August 6.

A Protest

The Editor:

Sir—I have just received a report of a very successful mining company operating in the West that, among other statements, gives full credit to the staff engaged, which is right and proper. My object in writing to you is to call attention to the sequence in which credit is given to the various departments: Assistant General Superintendent, Secretary and Purchasing Agent, Chief Clerk, Mine Foreman, Mill Foreman, Master Mechanic, Mining Engineer, Geologist.

Were I the engineer or geologist of that mine I certainly would prefer not to have my name mentioned, if it had to follow that of a clerk or foreman. Why educate our sons to be engineers if the mining operators rate them below clerks and laborers, high-class though they be?

ENGINEER.

Denver, Colorado, September 6.

CARBOCOAL is the name applied to a new product from bituminous coals now being made under control of the Government at Clinchfield, Virginia. The peculiarity of the process is that the coal, instead of being coked, is distilled at a temperature below 900° F. The residual material contains about 4% volatile matter, and burns readily on a grate, with a smokeless flame. Briquetted carbocoal has been tested by the Navy, and is reported upon favorably as a fuel for warships. The distilled products contain far larger amounts of toluol, naphthas, creosotes, ammonia, and other products than are obtainable by means of by-product coking. The process has been developed by Charles H. Smith.

The Development of Flotation at the Broken Hill Proprietary Mine, Australia

By EDWIN T. HENDERSON

Toward the end of 1902, with a view to finding a means of obtaining a zinc-concentrate from the dump-tailing, the late A. D. Carmichael, the company's research chemist at that time, was instructed by G. D. Delprat, General Manager for the Broken Hill Proprietary Co., Ltd., to carry out some experiments with nitre-cake (sodium-sulphate) of which we had a large stock. It was observed on placing some of the tailing in a strong solution of this salt in a beaker and heating it, that the sulphides were floated as a high-grade concentrate leaving the gangue in the bottom of the beaker.

An experimental plant was immediately started, and the results obtained were so encouraging that patents were applied for in November 1902, it being believed that this was something absolutely new in concentration methods.

Considerable difficulty was experienced at first in placing this new process on a commercial footing. First one type of separation vessel was tried and then another, until about a dozen had been used before a suitable one was designed. However, by the beginning of May 1903, fifty tons of zinc-concentrate had been produced by the process from tailing that was ordinarily dumped. This parcel was the first 50-ton lot of zinc-concentrate ever produced by flotation. After this the process made rapid strides, and by October 1904 was treating 500 tons of feed daily, which amount was gradually increased until, by October 1905, the output exceeded 1000 tons per day.

For the first four years this Delprat process was the subject of considerable litigation, the cause of which was a prior patent taken out by the late C. V. Potter, in November 1901, for obtaining the same result by the use of dilute acid solutions. Potter's patent was wide in its claims, vague, and in several parts erroneous, and it was contended that his patent was invalid, this contention being upheld by the Courts through which it passed. It was finally sent to the High Court, but prior to coming before that tribunal an agreement was reached between the parties concerned by which the Broken Hill Proprietary Co. obtained the free use of either the Delprat or the Potter patents.

From this time onward, owing to sulphuric acid being substituted for nitre-cake in the solution, the method became known as the Delprat-Potter process. It has been free from litigation, but the patents have now expired.

Although this process has been the subject of previous papers, there still seems to be some doubt in the minds of certain writers concerning some of the details, so that a brief outline of our practice at Broken Hill may be of value.

The feed consists of various tailings produced in the gravity-concentration mills, either from crude ore or old dumps, by crushing, jigging, and tabling for the removal of the lead, and classification for the removal of the slime. It is delivered to the bins of the flotation plant by a series of belt-conveyors.

This feed assays from 13 to 15% zinc, from 3 to 3.5% lead, and from 5 to 6 oz. silver per ton. An average sizing-test shows:

		%
On	40	7.0
"	50	6.5
"	60	10.5
Through	60	76.0

The gangue in the feed consists mainly of rhodonite, garnet, and quartz, with small amounts of fluorspar, calcite, and siderite. The feed as delivered to the plant carries from 9 to 11% moisture.

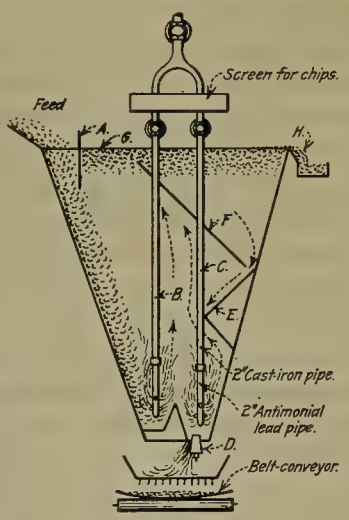


FIG. 1

The feed-bin has a capacity of 170 tons. The conveyor is set on top of this bin, and the feed can be dumped at any desired point. The discharge from the bin is by means of twin Archimedean screws set in the bottom of the bin opposite each separating-vessel. The amount discharged is regulated by slide-doors, which on being lowered partly cover the forward ends of the screws.

The cast-iron separating-vessels, of which there are five, are of the shape shown in Fig. 1. They are 9 ft. square at the top, 2 ft. by 1 ft. at the bottom, and 15 ft.

deep. The feed from the screw-feeders is delivered behind the baffle *A*, which dips a few inches below the level of the solution. It then slides down the back until it reaches the solution-jets at the bottom of the pipe *B*. These jets deliver the solution at a pressure of approximately 15 lb. per sq. in., at a temperature of 200° F. and an acidity of 1% H_2SO_4. The object of these jets is to keep the feed in suspension while the acid acts on the carbonates in the feed, liberating CO_2. This gas attaches itself to the sulphides and floats them to the surface. The back-jet *B* washes the feed to the front of the vessel where it meets another jet *C*, which gives it the final treatment. Any stones or other foreign matter in the feed lodge in the pocket below the jet *B* and accumulate there until such time as the vessel is emptied, when they are removed.

The tailing, after treatment by the jet *C*, passes through a hole in the plug at *D* in a practically continuous stream. The up-current in the separating-vessel, together with the stream of sulphides floating to the surface, tends to carry up some of the lighter gangue. In order to give this a chance to separate, two baffles are placed in the vessel. The one shown at *E* deflects the rising sulphide from the front and causes it to come into contact with the baffle *F*. It then moves up the under side of this and is delivered at the surface at the point *G*. It then floats toward the overflow at *H* on comparatively still water, and most of the gangue that was carried up falls again on to the top of the baffle *F*, down which it slides and falls to the bottom of the vessel.

The concentrate overflowing at *H* passes in a launder to a settler, where most of the accompanying solution is separated. The solids, together with a small amount of liquid, pass through plug-holes in the bottom of the settler on to a belt-conveyor, where the solution is drained and the concentrate removed to the bin. The tailing delivered at *D* falls into a trough with a perforated bottom, which breaks the fall, and then to a belt-conveyor where the solution drains and the tailing is delivered to a series of conveyors, which takes it to the dump.

The solution separated from the concentrate and tailing contains a small amount of slime, and to remove this it is passed over settlers. It is then pumped to the elevated solution-tanks, which give it the necessary head, by the Harris system of pumping by means of compressed air. This is done in two stages, the first lift being about 40 ft., and the second about 30 ft. Between these two lifts the solution passes through another settler, to remove any remaining slime, and then to a box feeding the second lift. To this box sufficient acid is added to bring the solution back to approximately 1.0%. Air-jets are used as a stand-by in case anything happens to the Harris pumps.

The fall in temperature of the solution is about 25° F. It varies slightly, depending on the temperature of the atmosphere and the feed treated. The consumption of acid is about 26 lb. per ton of feed treated. Approximately 30,000 gallons of solution are circulated per hour in the plant when running full and treating 80 to 85 tons per hour. The temperature of the solution in the elevated tanks is kept between 200 and 212° F. by blowing in superheated steam from the B. & W. boilers.

All the solution-pipes and the separating-vessels are made of cast-iron. On first being used they are slightly corroded by the hot acid solution, but they soon become coated with a thin layer of graphite from the iron, and this protects them from further corrosion. The separating-vessels and the return-solution pipes become coated inside with a layer of gypsum, which gradually grows in thickness and has to be removed occasionally. This deposit of gypsum is greatest wherever the solution is subject to a sudden fall in temperature, for example, where the air enters an air-jet.

Each separating-vessel treats from 15 to 20 tons of feed per hour. They require very little attention, and the whole plant is as nearly fool-proof as anything can be. The life of the separating-vessels is practically unlimited, provided the bottom portion is protected from abrasion by inserting a lining of wood.

Only 12 men and 2 boys are employed in the plant to treat 550 tons per shift of eight hours. The repairs are light, as there are few moving parts that come in contact with the feed or solution. The cast-iron screws on the feeders are made so that they can easily be replaced. The jets in the bottom of the separating-vessels are made of antimonial lead, and are burnt onto a 2-in. lead pipe; this pipe is about 18 in. long, and is flanged at the top and bolted to the cast-iron pipe. These can be easily removed when the holes become too large by replacing them with spares, the old ones being sent for repair.

The plugs that let the tailing out are made of antimonial lead; they are cast in a mold and are quickly and cheaply made. These plugs can be lowered by means of the lever-gear to which they are attached and enable any foreign substance to be discharged through the 4-in. diam. plug-hole. The hole in the plug itself for the discharge of the tailing is made about ¾ in. diameter. The The worn plugs are melted, a small amount of fresh metal being added to make up for the wear. It is then re-cast. The plugs can be easily changed while the pan is in operation. A lever with a forked end is placed under the shoulder of the plug to be removed to hold it in position; the spindle that supports the plug is then lowered and a new plug placed on it. The forked lever is then withdrawn, so as to allow the old plug to fall, the new plug being raised into its position. The wear on the hole through these plugs is largely taken up by inserting iron rods of varying thickness, according to the amount of wear, and they are only changed when the hole becomes too large for this treatment.

That portion of the separating-vessel that comes under the action of the solution-jets is lined with wood to prevent the sand scouring the cast-iron sides. This wood is renewed when it wears. The plug-seats are cast of antimonial lead, but these do not require to be renewed often, as the plugs fit well into them, and there is practically no leakage between the seat and the plug.

The concentrate produced by this treatment averages as follows: zinc 47%, lead 6%, silver 13 oz. per ton. An average sizing test shows:

	%
On 40	7.7
" 60	15.1
" 80	21.5
" 100	13.5
" 150	14.1
" 200	11.1
Through 200	17.0

The tailing assays 3% zinc, 2% lead, and 2 oz. silver per ton.

Some doubt has been expressed as to whether oil is used in this treatment or not, and I wish to make it perfectly clear that oil is not used in any shape or form in this process. It has been suggested that oil was introduced into the solution by using exhaust-steam from engines to heat the liquor, but since nothing but live steam from the B. & W. boilers is used, this is obviously not the case. It has also been said that the ore in passing through the milling operations picks up oil used for lubricating, and also that while being mined it is splashed with oil from the rock-drills; some even suggest that the ore naturally contains oil. No doubt some oil does come in contact with the ore in the milling operations, and also underground, but the amount is infinitesimally small, and although the concentrate produced has been tested on several occasions no trace of oil has been detected.

To show that the float is made without any oil, some ore was crushed and heated at a temperature of 400°C. for one hour, which should destroy any oil present. It was then treated with a 1% H_2SO_4 solution made up with distilled water and strong acid. A good float resulted.

This process is not adapted for the treatment of slime. The feed contains approximately 2 to 3% of slime, but if this amount is increased appreciably a low-grade concentrate is the result. The slime is also high in lead, and if included in the feed to this process it would raise the lead content of the concentrate produced. For the above reasons, the slime is separated as thoroughly as practicable from the sand in the milling operations, and only the sand sent to this plant. For some years the slime was run to dams and stored, awaiting a suitable treatment.

In 1910, Leslie Bradford discovered that by agitating this slime with a heated acid solution in a centrifugal pump, delivering into a separating-vessel, that the sulphides would float as a high-grade mixed lead and zinc concentrate, without the use of oil. A plant was erected capable of treating 3000 tons of slime per week. This was run for several months, and produced several thousand tons of concentrate assaying zinc 34%, lead 25%, and silver 40 oz. per ton. The tailing assayed zinc 4%, oxidized lead 8%, total lead 9%, and silver 4 oz. per ton.

This concentrate was roasted and sent as feed to the zinc-retorts at Port Pirie, but the quantity produced was largely in excess of the amount required for this purpose, and the plant was closed down until such time as the supply of concentrate was used up, or until a more favorable market became available.

The temperature required for this treatment was 140° F., and the acidity of the pulp was about 0.3% H_2SO_4. The separation was complete with four agitators and separating-vessels placed in series. The acid was added partly to the pulp at the head and partly to the suction of the various agitators. These agitators and separating-vessels will not be described here, as they are the same as those used in our present treatment, which will be described later.

The difficulty of marketing these mixed lead-zinc concentrates spurred the officers of the metallurgical department to find a better way of treating the slime, so as to get a zinc-concentrate practically free of lead and a lead-concentrate practically free of zinc. That the galena was much more readily oxidized than the blende was well known. In fact, the high lead content of the tailing produced by floating the sulphides from the slime was due to the oxidation of the galena during milling and subsequent exposure on the dumps.

In 1908, E. J. Horwood proposed that this property of lead sulphide be utilized in separating lead and zinc sulphides in slime, and in this connection a considerable amount of experimental work was done by the metallurgical staff, with the object of finding a commercial method of bringing about this oxidation. These experiments were finally successful, and led to the patenting in October 1908 of the Horwood process, the pioneer selective flotation process. This process is for the recovery of blende by flotation from ores containing blende, galena, and (or) pyrite. This is accomplished as indicated above, by oxidizing the galena and (or) pyrite and so rendering them unamenable to flotation while the blende, not being attacked, is floatable.

The most suitable way of bringing about this oxidation was found to be by roasting the slime or the mixed concentrate at a temperature of 400°C. and rabbling freely with a plentiful supply of air. If the ore to be treated contains soluble salts these should be removed by washing, as otherwise they will cause the blende to be attacked; this will cause loss of zinc, owing to solution and high acid consumption.

Oxidizing the lead in the wet way was also patented by Mr. Horwood, but when oxdizing agents are used the zinc is invariably attacked, although, of course, not to the same extent as the lead. The more rapid the action of these reagents on the galena, the greater the amount of blende dissolved, and only by making the oxidizing solutions weak is this trouble overcome, but then the time required to sulphatize the lead becomes excessive.

It was found that, with Broken Hill and like ores, the best temperature at which to sulphatize was 400°C. At this temperature the galena sulphatizes rapidly, while the blende is not affected. In the case of ores other than those of Broken Hill, carrying a large amount of pyrite, as well as zinc and lead sulphides, the temperature can nearly always be safely carried to 500°C., especially while the pyrite is burning. Little or no lead sulphate will be formed while pyrite is present, so this is burnt off rapidly.

Ores containing resinous blende invariably stand a higher temperature than those in which the blende is ferruginous. The sulphating operation requires plenty of air, and a good draught over the ore in the furnace is essential. While the sulphur is being burnt from the

pyrite, the ore will tend to flow somewhat, but as soon as the galena starts to oxidize the particles seem to cling together, and very little dusting occurs.

The extent to which the sulphating has to be carried to prevent the lead from floating varies with different ores. In some cases a 10% sulphatization is sufficient, while in others as much as 60 or 70% is required.

The subsequent flotation of the blende in the roasted ore is a simple matter, provided, of course, the temperature has been kept within the limit mentioned, and the soluble salt content of the ore treated was low. A slightly acidulated solution at a temperature of 130°F. has nearly always been found to give the best results.*

If no oil is used, the solution should be high in soluble salts, and should carry from 1 to 3% of sodium sulphate. The sodium sulphate acts as a mineral-frothing agent, and its use was covered by Patents No. 10640/13 in the Commonwealth of Australia by Mr. Bradford. A large number of tests have been made on a great variety of ores, and the process has been proved to have a wide application. In order to make tests on a working-scale, a small flotation plant was provided by the Broken Hill Proprietary Co. at the Bendigo School of Mines, where the requisite roasting-plant was already available. Working-tests were carried out to demonstrate the practicability of the process on both Broken Hill slimes and Tasmanian complex sulphides, from which latter a zinc-concentrate assaying over 58% lead was obtained.

Owing to the litigation between the rival claimants to the oil-flotation processes, which were then considered necessary for slime-flotation, the Horwood process was not used at the Proprietary mine, but was adopted by the Zinc Corporation, on whose property a plant to treat 70 tons per day of a mixed lead-zinc slime-concentrate was erected. The plant was working for about 12 months, but operations were suspended on the outbreak of war, as there was no sale for the concentrate produced.

The roasting was carried out in an Edwards duplex furnace of 12 panels, and this was found to answer well for the sulphatizing operation. The float was produced in a Minerals Separation machine of the staggered type, using eucalyptus oil as the frothing-agent.†

By the time litigation between the oil-flotation claimants ceased in Australia, Mr. Bradford and I, working together, had obtained encouraging results experimentally in preferential flotation without roasting, indicating the advisability of awaiting further developments before installing any selective process for the treatment of slime.

Before proceeding to describe the other methods of preferential flotation developed at our mine, a short account of the theory of flotation, as held by those engaged on the work, may prove useful to the reader. The old theory that flotation was due to the aversion of the sulphide particles to becoming wetted and that they were always surrounded under normal conditions with a film of air, is the one generally accepted here. Whether this aversion on the part of the sulphides is caused by electric charges, as first advanced by Professor Huntington in his evidence before the Royal Commission on the Potter-Delprat process in 1904, or not, has never been determined, for, in fact, it has always been looked upon as a natural property of sulphides. From a purely scientific point of view, it would undoubtedly be interesting to know why sulphides have this property, but from a practical point of view the fact that they have this property is self-sufficient. For the average man running a flotation plant, the simpler the theory the better. It is no good going to such depths that he cannot grasp the meaning, for then instead of being a help the theory only confuses him.

From the above old theory two main ideas attracted those who were engaged in experimental work on preferential flotation: (1) Since all sulphides have an aversion to becoming wetted, whereas oxidized minerals have not, or have not in the same degree, then a separation of one kind of sulphide from another kind of sulphide might be brought about by changing one of them to an oxidized state. This was done by the Horwood process. (2) Since the sulphide particle floated by aid of the film of air that surrounds it, then by removing this film the particles will become wetted and will not float.

The problem of bringing about this removal of the film was solved by Mr. Bradford in 1912, and again in 1913. His first method was by treating the ore containing galena and blende with a slightly acidulated sodium-chloride solution. This solution, especially at a temperature of 140°F. and above, has a slight chemical action on the galena. This chemical reaction generates H_2S, which diffuses in the air films around the galena particles and gradually removes them. The rate at which the H_2S is generated gradually decreases as the solution becomes less acid, and finally reaches a point at which it is not generated as fast as it goes into solution. When this stage is reached, the galena is wetted by the solution coming into intimate contact with the surface of the particles. Now by agitating the ore in this solution, the blende will float, but the galena will not. The acidity of the brine solution must be low, otherwise the H_2S will be generated faster than it can go into solution, and in that case the galena will not be wetted and will float with the blende.

This is known as the Bradford salt-sulphuric process. It has never been worked on a large scale, because by the time it had been developed sufficiently to be put to commercial use, Mr. Bradford had discovered another way of obtaining the results without the use of the brine solution.

The strength of the brine solution varies with the different ores under treatment, but from 5 to 10% NaCl will be found sufficient in most cases. The acidity must be kept low and should not exceed 0.03% H_2SO_4. A trace is nearly always sufficient. It is not always necessary to keep the solution acid throughout the separation.

*Details of this process appeared in the Transactions of the Australian Institute of Mining Engineers, Vol. 16, for 1912.

†A full description of this plant and its application is to be found in the Proceedings of the Australian Institute of Mining Engineers, No. 12, of 1913.

At the start it should be slightly acid, but this acidity will disappear before the separation has proceeded far, and it is then completed in the neutral solution. The temperature of the solution should be between 140 and 160° F.

Having removed the blende in this way, it may be necessary to concentrate the lead remaining in the residue before sending it to the smelter. This may be done in two ways: (1) By adding a small amount of a soluble copper salt to the brine solution, causing any sulphides remaining in the residue to float when submitted to aeration. (2) By removing the residue from the brine circuit and floating the lead in warm acidulated water.

The use of copper sulphate in assisting the flotation of sulphides was discovered by Mr. Bradford, and patented by him in 1913, Commonwealth Patent No. 8123/13. It was also covered for the same purpose by the Minerals Separation people in 1914, but Bradford's patent is recognized here in Australia. He did not cover its use outside the Commonwealth.

A practically complete separation of the lead and zinc sulphides can be made by the salt-sulphuric acid method giving a lead-concentrate of 65% lead and a zinc-concentrate of 50% zinc.

The following laboratory tests illustrate the capabilities of the process on Broken Hill crude ore:

No. 1

	Weight, %	Zinc, %	Lead, %	Silver, oz.
Original	...	12.4	15.5	11.5
Zinc-concentrate	20.9	50.6	3.5	11.2
Lead-concentrate	18.6	6.4	69.8	39.5
Tailing	57.8	1.0	0.6	1.6

The distribution of metals is as follows:

	Weight, %	Zinc, %	Lead, %	Silver, oz.
In zinc-concentrate	20.9	85.3	4.7	20.3
In lead-concentrate	18.6	9.6	83.8	63.9
In tailing	57.8	4.6	2.2	8.0
		99.5	90.7	92.2

No. 2

	Weight, %	Zinc, %	Lead, %	Silver, oz.
Original	...	15.8	16.0	12.9
Zinc-concentrate	25.0	52.0	2.7	5.6
Lead-concentrate	20.75	9.6	65.2	50.0
Tailing	52.5	1.2	2.7	1.6

The distribution of metals is as follows:

	Weight, %	Zinc, %	Lead, %	Silver, oz.
In zinc-concentrate	25.0	82.3	4.2	10.8
In lead-concentrate	20.75	12.6	84.5	80.8
In tailing	52.5	4.0	8.8	6.5
		98.9	97.5	97.7

The second method of removing the air films from the sulphide particles was discovered by Mr. Bradford in 1913, and patented. This was brought about by either causing a soluble gas to be generated in the ore-pulp under treatment, or by forcing it in under pressure. The gas, by diffusing in the air film surrounding the sulphides, causes the film to be removed, and then, being itself soluble, allows the solution to come into intimate contact with the surfaces, and so wets them. The soluble gas used is SO_2 and this is either generated in the pulp by adding hyposulphite (or any other reagent that will liberate SO_2) and sulphuric acid, or by blowing SO_2 gas produced from roasting operations, or by burning sulphur into the pulp while it is being stirred. In some cases both these methods are used together. If the pulp, after being treated in this manner, is subjected to agitation with air, then those particles that have a greater aversion to being wetted will take the air and float, while those that have not such an aversion to being in this state will remain with the gangue.

This process has been in use on a large scale by the Broken Hill Proprietary Co. and also by the Broken Hill Junction North Co. for some time, and excellent results are being obtained. The process is now being adopted by several other Broken Hill companies, which have purchased the Broken Hill rights from Mr. Bradford. The complex sulphide ores from the Rosebery-Hercules mines, in Tasmania, containing blende, galena, and pyrite, gave a zinc concentrate containing up to 58% zinc, with recoveries from 80 to 85%.

The following laboratory test illustrates the work done by the process on Broken Hill slime:

	Weight, %	Zinc, %	Lead, %	Silver, oz.
Original	...	13.9	7.4	6.8
Lead-concentrate	12.9	8.7	43.4	41.8
Zinc-concentrate	21.4	50.7	4.0	3.4
Tailing	63.2	2.4	1.5	1.1

The distribution of metals is as follows:

	Weight, %	Zinc, %	Lead, %	Silver, %
In lead-concentrate	12.9	8.1	75.6	79.3
In zinc-concentrate	21.4	78.0	11.5	10.7
In tailing	63.2	10.9	12.8	10.2

A description of this process will form the subject of a separate paper.

EXPORTATION OF SILVER. The melting down of the silver dollars in the United States Treasury and the exportation of the bar silver resulting and other silver bullion possess great interest to the average American citizen. Most of this silver bullion is sent to India, whose people have a strong prejudice in favor of metal money, and India is exporting a vast amount of material used in the War by England and France, and, in fact, all the entente allies, including ourselves. To pay for these goods in the money desired by the people of India caused a tremendous drain on the supply of silver of entente allies, and to meet this urgent demand the United States has taken the great amount of silver bullion and silver dollars lying idle in its Treasury and is exporting it to India to be used in paying for war supplies. Something like a hundred million silver dollars have been melted down and exported. What great assistance it was to the allies, including the United States, is shown by the statement of Sir James Meston, financial member of the Viceroy's Council, who is reported as saying: "Probably few people in America realize how vitally important to India and to India's share in the War was the legislation passed in Washington releasing large quantities of silver for use in alleviating the currency situation there. For this action India as well as the British Empire and the allies owe a debt of gratitude to the United States which it is hard to overstate."

Lead Salts in Cyanidation

By THOMAS B. STEVENS

*Most cyanide solutions require the addition of varying quantities of lead salts to correct the effect of soluble sulphides. Lead is also required to form a zinc-lead couple in the zinc-boxes so as to aid precipitation.

Prior to the outbreak of war, acetate of lead, which is the most common soluble lead salt, was almost universally used for these purposes. The only notable exception was at the cyanide plant of the Homestake company in South Dakota, where nitrate of lead was used. With the shortage of European supplies of acetic acid, lead acetate could only be obtained from the United States. The latest London quotation is £145 per ton (31 cents per lb.), compared with a pre-war price of about £30. The price in America is 15c. per pound. The price of lead nitrate does not show such a large advance, the present price being £65 per ton (14 cents per lb.). This is due to many large plants having been erected in England for the manufacture of nitric acid. Lead nitrate has never been a common commercial salt to the same extent as the acetate.

Lead acetate is prepared by dissolving oxide of lead (litharge) in crude acetic acid. The chief source of acetic acid is from the distillation of wood. This was an important German industry. Not only has the War cut Australia off from supplies of this acid, but at the same time the demand for it has increased. Acetone is a derivative of acetic acids, being prepared by the dry distillation of calcium acetate. It is largely used in the manufacture of cordite, a most important munition. Acetone is at present unprocurable in Australia.

The scarcity of lead acetate has caused metallurgists to direct more care to the use of other salts of lead. Litharge is an Australian product, being made at the works of the Broken Hill Associated Smelters at Port Pirie, South Australia. It is an insoluble salt, but it may be dissolved in either caustic alkalies or acids. Caustic alkalies dissolve it to form plumbites ($CaPbO_2$) and an admixture of slaked lime and litharge has been largely used to precipitate soluble sulphides from working cyanide solutions. It is probable that the protective alkali usually present in cyanide solutions is in itself sufficient to cause finely-ground litharge to act as a precipitant of soluble sulphides. At some mines an economy is affected by feeding used cupels from the assay-office into the tube-mills, or other parts of the grinding-plant; but at mills where concentration is practised, the litharge must be thoroughly dissolved before introduction into the plant circuit, as the concentrating tables will separate it out owing to its high specific gravity.

*Abstract from 'Monthly Journal' of Chamber of Mines of Western Australia.

For the formation of the zinc-lead couple in zinc-boxes, solutions of lead in the form of plumbites are useless, as the lead is contained in the positive radical and cannot be replaced by zinc. This may be readily proved in the laboratory by dissolving a little litharge in boiling caustic soda, and then immersing zinc shaving in the solution, when no deposition of spongy lead will take place. At the present time for coating zinc shaving, litharge is usually dissolved in nitric acid just prior to use. This is cheaper than purchasing lead acetate. Lead nitrate in crystalline form is unprocurable except by purchase at a high price from the Cape Explosives Works in South Africa. The reaction for dissolving litharge in nitric acid is easy to perfom and requires no heat, so that the use of a steam-jacketed pan such as is required when metallic lead is dissolved, is avoided. An earthenware jar to hold five gallons is all the apparatus required. To make 10 lb. of nitrate, 7 lb. of litharge ground to as fine a powder as possible, is added gradually to 1603 cc. of 70% (sp. gr. 1.41) nitric acid, which has previously been diluted with 6500 cc. of water. The whole is stirred with a wooden stick for 10 minutes. The weights and measures in this form are those usually most easily available at cyanide plants. The reaction causes the solution to get moderately warm to the hand, and when it is completed any undissolved excess of litharge will readily settle to the bottom. The solution of lead nitrate that will be neutral to litmus can be decanted off readily. It is advisable to work with a slight excess of litharge, as it can be left in the bottom of the jar to form part of the next charge; by this means the full strength of the nitric acid is utilized. It is also important to dilute the acid with water as directed, before the addition of the litharge, otherwise some insoluble basic lead nitrate is likely to be formed. To make 100 lb. of lead nitrate, 67.4 lb. of litharge and 38.1 lb. (100%) of nitric acid are required. The present price of 70% nitric acid in jars at Kalgoorlie is £80 per ton, corresponding with £114 for 100% acid. The price of litharge at the same place is £58. The cost of making a ton of lead nitrate is £82.5, being £39.1 for litharge and £43.4 for nitric acid. Efforts to get the nitrate made at the works where the acid is produced, and to save the high freight on the acid, as done in South Africa, have failed. The small amount of nitrate consumed by our mills does not make it worth while for the acid manufacturer to install the necessary plant. Lead nitrate—$Pb(NO_3)_2$—contains 62.5% of lead, compared with 54.6% in the acetate—$Pb(C_2H_3O_2)_2 \cdot 3H_2O$—and as it is the lead content only which is of use, in round figures 9 lb. of the nitrate is as valuable as 10 lb. of the acetate.

Rotterdam, the Distributing Centre for the C. R. B.

By WALTER LYMAN BROWN

Rotterdam, in Holland, has been, since October 1914, the date of the fall of Antwerp, the only port of entry for Belgium, and so was, of necessity, chosen by Herbert Hoover, as the centre of entry and distribution when he organized the Commission for Relief in Belgium. Hoover (the 'Big Chief'), W. L. Honnold, the present director at New York, Edgar Rickard, and Millard Shaler, who have been with the C. R. B. from the beginning and who helped to start this office, besides two of the assistant-directors here and the writer (the present director), are all mining engineers. Moreover, W. B. Poland, the director in London, and the two early directors in Rotterdam are also engineers; thus the organization has consisted largely of members of our profession.

The Commission supplies practically all the food of Belgium and 'occupied,' or invaded, France. The population thus served consists of 9¼ million, divided roughly into 2 million French and 7¼ million Belgians. Belgium is again divided into the General Government and the Ettappes of the 4th German Army, which occupies East and West Flanders, the populations being relatively about 5½ and 1¾ million. Rotterdam is therefore the connecting link between the outside world and the invaded territories.

Supplies originate principally in the United States, nearly 80% of our purchases coming from there; however, large quantities of maize and wheat are shipped from the Argentine; coffee, rice, peas, beans, soap, and clothing have come until recently from England; later, increased quantities of foodstuffs have been purchased in Holland. But from whatever source, all supplies converge here and are in turn distributed to the various destinations in accordance with the adopted program and the respective needs of the provinces and districts of Belgium and France.

The principal method of shipment is by canal, with which Holland, Belgium, and Northern France are well served; the gateways, going from west to east, are Ghent, Antwerp, and Liège, the principal one being Antwerp. It is the excellent canal system of these countries that has permitted distribution to be carried out, not only at a reasonable cost but at any price, as under the pressure of war, with its huge demands on and wastage of rolling-stock, it would have been utterly impossible to ship the C. R. B. supplies by rail. The canals and locks are of all sizes, big lighters of 2000 tons capacity being used to Antwerp and Ghent, whereas Northern France, Hainaut, and Namur can only be reached with small 38-metre boats of 270 tons.

The shipments into Belgium and Northern France for the first three years were as follows:

Year	Metric tons
1915	951,005
1916	1,281,569
1917	789,098

and a further quantity of 600,000 tons has been dispatched up to June of the current year.

These shipments are confined to a few articles only, and these of the highest calorific value at the price. Our finances had to be hoarded just as carefully as the working-capital of the small mine that we all know. Wheat is the principal foodstuff, and it was early established that it was better to import whole grains to be milled in the country, with the consequent labor for the people and the yield of by-products for cattle-fodder, than to ship flour. Wheat accounts for 62% of the whole, bacon and

GERMAN MAP SHOWING LIMITS OF BLOCKADED AREA ON FEBRUARY 1, 1917

lard 5%, maize 10%, rice, peas, and beans 10%, leaving only 13% for sundries.

Every shipment into and out of Rotterdam has a number affixed to it, and is known to history and the swearing Chief Statistician by that number. This applies equally to the gift of a Dutch cheese, a 10,000-ton cargo of wheat ex the 'New Amsterdam,' or a present of a barrel of candy from the children of Berkeley to the children of Louvain. On June 1, 1918, arrival No. 2206 had been recorded, lighter shipment No. 9033 had gone forward, and rail shipment No. 5711 had been dispatched.

Sixty destinations are served from Rotterdam, the longest haul being 334 kilometres to Charleroi, and the shortest 141 km. to Antwerp. The average is about 145 miles and the total cost of freight and towage averages one Dutch cent or two-fifths of one American cent per metric ton-mile.

The equipment can be divided into incoming (overseas), discharging, and outgoing (canal transport). Our overseas fleet consists of, firstly, Belgian steamers of approximately 125,000 tons carrying capacity. These are supplemented by five small American vessels of the Wagner fleet and one French ship, all the above being on time-charter for practically continuous service. This does not meet half the needs, which are about 325,000 tons in all, and so neutral trip-charters have to be secured to make up the balance. Norwegians have furnished most of this tonnage, and here I would like to add a word of appreciation of the Norwegian sailors who have kept the seas against all odds, and have helped not only the C. R. B. but the whole Allied cause more than any other neutral nation. Lately, however, Swedish vessels have taken our charters in considerable numbers and a few Dutch have periodically been in our service. All these ships sail under special markings and safe-conduct passes, photographs of which are attached. They must follow special routes outside the danger zone as proclaimed by the German government. On the whole, these passes have been fairly well treated by the Germans, though there have been a number of cases of torpedoing during the three and a half years that they have been in operation, and there has been lately one case of confiscation before the Prize Court.

About a year after the beginning of the Commission, four grain-elevators belonging to the city of Antwerp, but lying in Holland, were taken over by us and with these most of the bulk grain (wheat and maize) has been discharged. Working with these elevators, all records of the port of Rotterdam for quick dispatch have been broken, and as Rotterdam is probably the best equipped port, this may constitute a world's record. Herewith I quote a few instances of rapid discharge:

Steamer	Cargo	Material	Discharged in hours
Sagama River	7120	Wheat	17¼
Photinia	7386	"	17
Grangesburg	9641	"	20
Pontoporos	6000	Bacon and lard	76

All cargoes of bulk grain are handled directly by the C. R. B., general cargo being discharged by stevedores on contract at about 30 cents U. S. per ton. Our own grain-elevator discharge, of course, is much cheaper, averaging only about 12c. per ton. Most cargoes are transhipped directly into lighters for forwarding to the Occupied Territories, though a small amount is usually sent by rail to the Liège district, and sometimes considerable quantities are placed in storage awaiting the various Government permits for shipment.

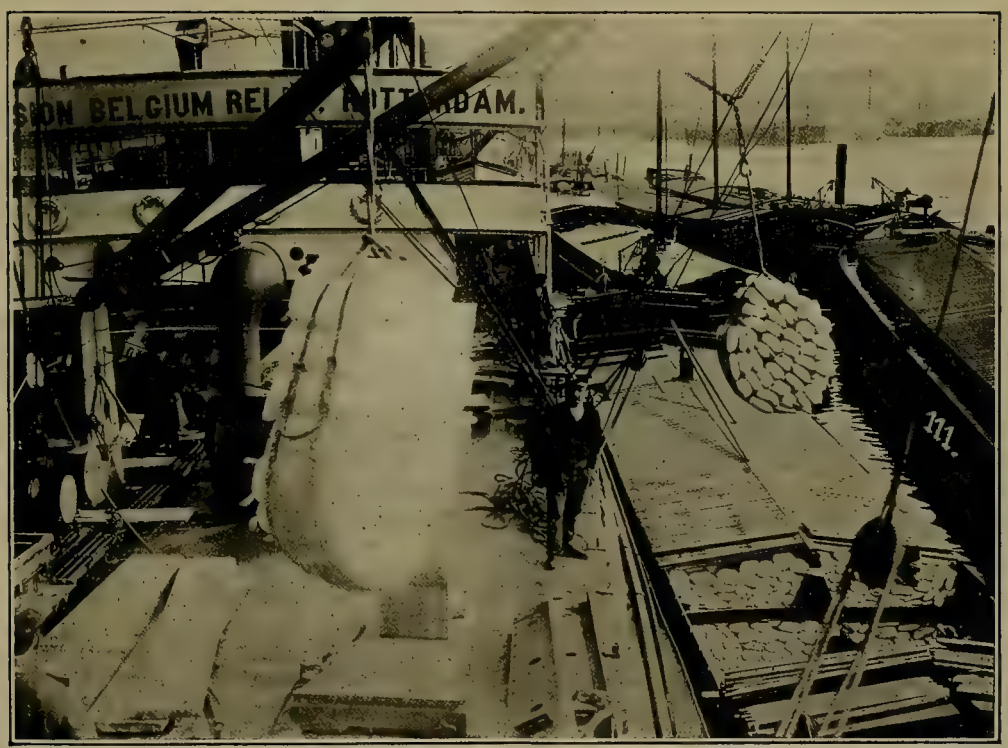
The formalities to be gone through to get a lighter into Belgium are numerous. German passes for the crews have to be secured, and to these are attached photographs showing everyone, from the skipper and his wife to the inevitable dog, and as the Germans latterly have insisted on having all on one picture, the difficulties of the photographer in getting them together can well be imagined. Belgian skippers do not believe in 'race-suicide'; one often sees a family of ten and the crew living in the two or three little rooms that serve as accommodations. For each shipment a special German permit has also to be given authorizing the German frontier-posts to pass the cargo. The Dutch formalities are no less strict. All cargo is discharged from overseas and re-loaded for Belgium under severe customs control, to prevent smuggling, which is a very remunerative trade, owing to the exorbitant prices that all 'free' foodstuffs command, both in Holland and Belgium. The least infraction on the lighterman's part causes trouble and delay, and the complete discharging and re-loading of cargoes at Hansweert, the last Dutch border-station, is often ordered. To one without the experience it is impossible to believe the amount of red tape and delay that can be crowded into a country as small as Holland.

Here, however, I want to state that the Dutch have an extremely difficult problem in the smuggling question, as Germany welcomes it with open arms and huge prices are paid for all contraband. Holland is doing its best to cope with it and is succeeding as well, probably, as any other country could. Also, the Dutch government has always given the C. R. B. every assistance in its power, smoothing away all possible difficulties, and helping us with large concessions, both financially and otherwise.

The ingenuity displayed by lightermen to circumvent the laws is worthy of a better cause, and would go a long way toward winning the War if applied along proper channels. Theft, as well as smuggling, has to be combatted, and a special Control Department has just been organized to attend to this trouble. This department inspects all lighters before, during, and after loading, in close co-operation with the customs officers, checks the sealing of the boats, controls weights, and, in fact, all operations in connection with the cargo; it has special watchmen along the canals, and convoys fleets of lighters to the frontiers to prevent theft en route.

That this control is effective is shown by the fact that the total losses on shipments between Rotterdam and the Belgian and French destinations have averaged only 15 hundredths of 1%, careful weighing and tallying taking place at both ends. Included in this difference is the usual natural loss of weight in shipment, this being especially marked in maize and bacon, thus leaving only a small margin for theft and fraud. This figure is con-

C. R. B. FLOATING ELEVATORS AT WORK



DISCHARGING FLOUR FROM STEAMER TO LIGHTER

siderably better than that accepted as normal by European shippers before the War, and under the present difficult circumstances must be considered remarkable.

As before said, lighters and tugs are used for the internal transport. As in the case of overseas tonnage, the basic lighter fleet consists of about 300 time-chartered Belgian boats to supplement which trip-charters are made as required. Most of this fleet was in Belgium at the time of the German occupation, and over this the German claim jurisdiction. The date from which this jurisdiction should count has been the subject of long negotiation, the Germans first holding to the date of the fall of Antwerp, but we finally secured an extension to December 17, 1915, all boats in Holland before that date to be 'free' and those in Belgium to be 'controlled'. For 'controlled' lighters a 'caution' has to be paid, to cover which we have put up a blanket-bail of 100,000 marks, to ensure that they return to Belgium. 'Free' lighters travel without caution, on a pass, which covers both the inward and outward trips.

The Germans are under guarantee not to interfere with our necessary transportation equipment, but as their needs from military transport increase so our problem grows more difficult. They continually press for the release of our boats and we as continually resist under the guarantees.

Tugs pull the lighters and a fleet of about 45 is kept for this purpose. This is sharply divided into those for internal use, numbering about 25, and those that work only in Holland, from 15 to 20. At first, Belgian tugs were principally used, but later, as certain of these had to be given up to the Germans and as the work increased, it became necessary to charter Dutch tugs and several were also purchased. In order to use Dutch tugs in Belgium, guarantees, to the satisfaction of the Dutch government against requisition by the Germans, had to be secured, as well as special permission to allow them to leave Holland.

From the first, the principle of the C. R. B. distribution has been 'Feed the people! Do it as cheaply as possible, but above all, keep the food moving.' That this policy has not been unsuccessful is shown by the fact that the daily bread-ration has never failed to reach the most remote village in Belgium or France, though it has been touch and go many times. Twice famine was averted only by generous loans of wheat by the Dutch government. At times, the rations have had to be reduced from their already pitifully low basis, owing principally to the sinking of vessels by submarines or mines, and especially to the great delay and loss of ships at the beginning of the sharpened submarine warfare in February 1917; but always the food available has been equally distributed to all, rich and poor alike, to Brussels, Bruges, or St. Mihiel, and often within range of the guns along the front line. Our delegates in France and Flanders have been shelled by French artillery and bombed by British air-men while visiting the villages near the front.

One of the many difficulties to be faced appeared first in the winter of 1916-'17. This was the freezing of the whole canal system of Holland, Belgium, and France. The possibility of this had been foreseen and at a meeting between the German military Eisenbahn Direktion, the Dutch State Railways, and the C. R. B., held at Esschen, on the Dutch-Belgian frontier, it had been agreed that the Germans would supply 300 fifteen-ton trucks daily, that the Dutch government would supply locomotives and free haulage to the frontier, and that the C. R. B. would guarantee to load the above trucks daily, allowing no demurrage to accrue.

The freeze came with little warning and as the lighters had to be dispatched up to the last possible moment, it was necessary to change over-night from a smoothly running system of water transportation to shipment by rail. Bulk wheat from America was the principal cargo to be handled and the Dutch practice was to bag the grain before shipping by rail. All the Rotterdam bagging stations were working for the Dutch government, which was also in difficulties. So the first day a thousand men were started bagging by hand, but by the afternoon it was apparent that this would not meet requirements; to load loose in the cars was the only solution. We were told that it could not be done, and, on asking why, the answer was, "Because it has never been done in Holland." However, on the second day, all the elevators were discharging from lighter or steamer directly into the railway-trucks and on the third day Brussels was being sworn at for not sending along the empties fast enough, as we were waiting for them.

The question was further complicated by the fact that the submarine blockade had just been declared and there were practically no arrivals of steamers from overseas. So the reserve stocks in storage-lighters at the Waalhaven (the big storage basin of Rotterdam) had to be broken out of the ice. This was, in places, a metre thick, so that ice-breakers on powerful tugs were used until several of them were badly damaged, and finally, men with saws and axes had to cut them out and bring them to the loading-points. Also, just at this time, the Germans were withdrawing to the Hindenburg line, and needed rolling stock as badly as we did, though for quite another purpose. However, the food was moved to all destinations, 3213 trucks being loaded with 46,480 tons of wheat and general cargo during the 18 days devoted to this work.

Not the least interesting phase of the C. R. B. work has been the negotiation with the Germans. In January 1917, just before the United States severed diplomatic relations, the German military had been pressing us to stop chartering lighters and tugs, and even to give up 100 lighters already on time-charter, as they had great need of shipping room, also apparently for the retreat to the Hindenburg line. A conference was arranged in Brussels and three of us sat facing what appeared to be the whole staff of a German army corps, from the General down, and all wearing the Iron Cross. There was only one thing to do: sit tight on the guarantees, that our necessary transportation facilities would not be interfered with. We sat and they talked for nearly two hours, but the net result was that we kept our fleet.

Negotiations over safe-conduct passes are, like the poor, always with us, and have finally resulted in arrangements whereby passes can be issued by the Swiss minister at Washington (representing German interests) for all cargoes from North America, the Swiss minister in Rio de Janeiro and the German minister in Buenos Aires for South America, and the German consul at Las Palmas for cargoes bought afloat and calling at that port. During the last few weeks this has been extended to include Bergen, in Norway, also for cargoes bought afloat, and negotiations are still pending to cover other points. Return passes to America or to the first port of call (not including the prohibited zones), good only if traveling in ballast, are all issued by the German legation at The Hague. These safe-conducts are given for all C. R. B. overseas cargoes and provide that, subject to our goods only beng carried, full Commission markings being flown and the vessel remaining outside the danger-zone, no attack or seizure shall be made by German naval forces. On the whole, these passes have worked fairly satisfactorily, though there have been certain "regrettable incidents."

THE 'HOOVER,' SPEEDY AND RELIABLE, AS USED ON AN INSPECTION MADE BY THE FRENCH AND AMERICAN MINISTERS

C. R. B. STEAMER, SHOWING SIDE BANNERS, SIGNAL BALLS, AND PENNANTS

The German blockade brought up another question, that of bunker-coal. For the first two and a half years all vessels had called at English ports for bunkers and inspection, but after February 1, 1917, they could only

do so without a safe-conduct pass and at the risk of being torpedoed on sight. This cut off the coal supply, as Holland has no mines able to yield coal of quality, but relies entirely on imports, which, in these days, are principally noted for their absence. So it was made clear that Germany must make up the deficit, as her action had cut off English supplies. Arrangements were made with Brussels whereby German bunkers would be supplied against Belgian coal from Mons and Charleroi to be transported to Holland by the C. R. B. This, in a few months, proved to be impracticable owing to insufficient Belgian coal being available and to the increased shortage in Holland, so new arrangements were made at The Hague in July 1917, whereby the Commission would be treated by Germany as a separate neutral State and rationed according to its requirements, which were estimated at about 15,000 tons monthly. This arrangement still continues, with, on the whole, fairly good results, though the price paid is from three to four times the pre-war figure.

The submarine blockade has made more trouble for this office. Many ships having been sunk and the sailings of others having been interrupted, imports fell to a low figure. Therefore it was decided to purchase the maximum quantity of Dutch-grown foodstuffs. This was a most complicated matter. All the exports from Holland were regulated by agreements made with England on the one hand and with Germany on the other. These agreements specified exactly what proportion of various articles could be sent 'overseas' and 'overland', that is, to England and France or to Germany. England agreed that all the C. R. B. purchases should count as a part of the so-called E. F. portion, but in each case, British permission to buy had first to be secured. Germany, who controlled the frontier, would only allow Dutch foodstuffs to enter Belgium under special permits, granted for individual shipments only, for she looked with jealous eyes on our purchases as leaving so much less for the 'Vaterland'. Holland was tied by her agreements with both belligerents and by the exigencies of feeding her own people. So every purchase memorandum had to be submitted to three governments for their approval, and just as, after strenuous endeavors, 2000 tons of beef or 10,000 tons of potatoes had been found, and Lille had been promised a little variation in her starvation rations, one side or the other, but usually the German, would step on the deal and a new start would have to be made along a different tack.

A Purchasing Department, with its branches of inspectors and controllers, was organized, which, within a month, was buyng at the rate of from two to two and a half million dollars monthly. During the eight months that it was in full operation about 75,000 tons of Dutch foodstuffs were bought and shipped to Belgium and France, these varying from sauerkraut to sausages and from Edam cheese to eggs, and including fresh meat, fish, butter, jams, and vegetables. This proved to be of great assistance in helping to make up the shortage in regular imports, and almost equally in the moral effect of giving a little variety to people who had been merely existing for three years on the gray bread, rice, peas and beans, bacon, etc., of the usual program. The cost of handling was much greater per ton than for the imported foods, owing to having to collect the small parcels from all parts of the country, and also the purchase-cost per food-unit was higher, but it was well worth the extra expense. It is only to be regretted that Holland's own food shortage has caused this supply to be cut off for the last six months, and that there seems little likelihood of its again becoming available in appreciable quantity.

The cost of carrying out the operations of this office will probably be of interest, and therefore a summary of the first three years is given below:

Statement of Expenditure for the Three Years Ended October 31, 1917

Tonnage shipped to Belgium and Northern France 3,021,672

Expenditure not chargeable against Rotterdam office operating costs

	Florins
Purchase cost	41,396,984.55
Sea-freights	31,306,537.79
Bank interest (credit)	66,453.05
Exchange	4,058.62

Operating Cost

		— Cost per ton —	
Shipping expenses		Florins	Dollars
Beyond freights	4,423,838.37	1.463	0.5852
Transhipping	1,355,318.57	0.448	0.1792
Extra transhipping (including control and inspection)	809,333.25	0.268	0.1072
Clothing and lace department expenses	116,122.70	0.039	0.0156
Storage and warehouse	278,748.56	0.093	0.0372
Bags and tarpaulins	49,496.03	0.017	0.0068
Harbor expenses	34,088.28	0.010	0.0040
Total	7,066,945.76	2.338	0.9352
Office and General Expenses			
Salaries	312,281.90	0.103	0.0412
Traveling expenses	86,458.70	0.029	0.0116
Telegrams, telephones, postage	25,284.57	0.008	0.0032
Stationery and printing	15,485.34	0.005	0.0020
Rent, taxes, and insurance	11,338.31	0.004	0.0016
War-risk and marine insurance	9,054.72	0.003	0.0012
Lighting and heating	7,870.73	0.002	0.0008
House-keeping expenses	9,860.20	0.003	0.0012
Auto expenses	11,168.82	0.004	0.0016
Sundry expenses	40,357.33	0.014	0.0056
Branch-office expenses	24,365.26	0.008	0.0032
Total	553,525.68	0.183	0.0732
Total operating expenses	7,620,471.64	2.521	1.0084
Grand total	80,261,599.50	= $32,104,639.82	

The tons are metric of 1000 kilo., and florins are converted at the pre-war rate of Fl. 2.50 = 1 dollar.

These costs, which cover all operations from the time that a steamer enters Rotterdam till the foodstuffs are delivered to the mills or warehouses of Belgium and France, while already low, include various items that do not strictly belong to operating expenses. The working of the rented elevators is much cheaper than the current rates of the port, but Transhipping Charges have always been debited with the Port Tariff, the savings being credited to London for the Benevolent Fund. The same applies to the extra expenses incurred in rushing the discharge of steamers on demurrage, or for which 'dispatch clauses' have been secured in the charters. Large sums have been saved or earned in this manner, but these are credited to 'Sea-Freights' at London, the costs being charged here.

Clothing and Lace Department expenses are also extras, although they present one of the most interesting phases of our work. The lace is Belgian, made by about 50,000 women, to whom, through a wonderfully fine organization of ladies in Brussels, the C. R. B. supplies the necessary thread and markets their product.

Topography From Moving Objects

By A. J. SALE

It seems unfortunate that, since the present war had to come, it did not come ten or twenty years sooner, when the 'frontier engineer' was in his prime. By the 'frontier engineer' I mean the sort of man that entered the mining camps of the West before the advent of the railroads and had to adjust himself to the most adverse conditions. Many of these men have had to improvise a surveying instrument by nailing two sticks together; to run levels by tying a rock to a carpenter's square; to titrate assays on a spot-plate made from the top of a casserole; to weigh assay buttons with weights made of tissue paper; in short, to adjust themselves to an infinite number of difficult conditions. Should Russia resume the offensive as our ally, her frontier problems will demand the old-time engineer, who will become of considerable military importance, irrespective of age or physical perfection. Examples of this kind of work are the following:

In Fig. 1 is shown an exaggerated instance of the development of a true straight-edge from a rough flat stick. Lay one side of the stick upon a paper and draw a line along its face; rotate around this line until the other side is against the paper, and draw another line along the face; now connect the consecutive points of contact by short straight lines, using a match or similar object for a small ruler. The result will be a perfectly straight line of any desired length; and if the stick be whittled exactly to fit this line, a practically perfect straight-edge will be obtained.

To construct a reasonably accurate engineer's scale requires that one apply a sort of Bertillon system to himself. Most of us have a fairly accurate idea of the length of our normal stride, the span between the tip of our thumb and little finger, and other personal constants; but these are not of sufficient accuracy for the construction of a scale. I find, for example, from several careful measurements, that my two lower canine teeth have sharp points which are exactly 1.17 inches apart. In Fig. 2, I show how I constructed an inch measure by biting into a piece of paper: AB represents the line between the centres of the original tooth-marks, or 1.17 in.; draw AC at random; on the edge of a piece of paper mark two sharp lines about a sixteenth of an inch apart; starting at A, copy off five of these divisions on the line AC toward C; on the edge of another piece of paper measure the length of these five divisions, and transfer it along AC from point 5, which will locate point 10; in a similar manner, locate point 20 from point 10; after this locate every 20 up to 120, which call point C; from the 120 point, measure back 3 of the small divisions for 117, which call point D; draw a straight line between B and D; from the 100 point E, draw a parallel to BC, using improvised straight-edges or direct measurement improvisations as desired; if F is where this parallel intersects AB, then $AF : AB = AE : AD = 100 : 117$; or $AF = 100/117 \times 1.17 = 1$ inch. This inch-measure can be subdivided as desired by completing the subdivisions on AD, and drawing additional parallels to BC. If the full number be used, the final subdivision will be 1/100 of an inch. After completing the inch measure, it can be transferred to as long a straight-edge as desired. I have constructed several rules by this method and find them to be remarkably accurate. Two file-marks on the thumb-nail will preserve a fixed measure for a limited time, but I do not consider this as accurate as the method described.

In Fig. 3 is explained the construction of a true 90° angle from a block of wood having two straight faces somewhere near perpendicular to each other. Lay one face against a straight line and draw a line along the other face; now rotate until the second face is against the original straight line; then draw a line along the first face; the bisection of the angle between the lines as drawn will be a true perpendicular to the original base line.

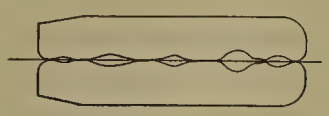


FIG. 1

FIG. 3

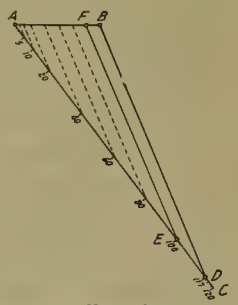


FIG. 2

To bisect an angle without implements, mark two fine lines along the edge of a straight piece of paper at any desired distance apart; transfer this distance to each side of the angle to be bisected, thus developing an isosceles triangle; on the edge of the same straight piece of paper, lay off a distance which is approximately half of the base of the isosceles triangle; transfer this distance to the base from each side; the result will be two points so close together that the intervening distance can be accurately bisected by the eye.

For a 60° angle, perforate a piece of paper or thin board with a pin at one end and with a sharp pencil point at the other. With this implement draw a circle and lay off the radius at some convenient place on the circumference, which will develop an equilateral 60° triangle. Bisecting the 60° angle, we obtain 30°, which

again can be subdivided to 15°, or smaller if desired. When sufficient triangles have been made, it would not prove a difficult task to construct a fairly accurate paper protractor.

Having prepared sufficient working-tools, the engineer is in a position to attempt the mapping of enemy territory. The moving object from which the topography is observed can be any ordinary conveyance, of which by far the best would be an aeroplane. The advantage of being in motion is the decrease in the chances of being hit by the enemy and the more rapid covering of territory by all conveyances except the aeroplane, which necessitates taking observations while in motion, even if it did not have the above advantages. To start this work the engineer will measure off a base line in a fairly safe position behind his own lines. If he has a transit, tape, level, and the other common accessories, this will not be a difficult task, but if he has nothing to work with he can keep the line straight by sighting over a rifle barrel, and use the other improvisations previously described. If transits are available, one man at each end of the base line might prove sufficient, as they can follow both the horizontal and vertical movement of the field observer at one sight, but if it is necessary to rely upon improvised graphic angles, a much larger crew will be required, as the observations must be made on the instant that the signal is given. If the field observers have a good compass and clinometer, two men should prove enough; if, however, they have to depend upon graphic angles, it would probably take at least three.

When everything is ready, the field observers will make a trip around the territory to be mapped, take photographs, or make sketches, and mark important points by numbers. I find that concentration of mind is as essential as good eye-sight for this type of work. Having completed the preliminary preparations, the field observers will start a circuit in front of one end of the field to be covered. They give the signal for No. 1, and at the same time they read the bearing (or mark the graphic angle) to point No. 1; also read the vertical (or mark the graphic) angle to the same point. This reading can conveniently be recorded as *A*, 1 horizontal and *A*, 1 vertical. At the instant of signal No. 1, each of the base-line observers reads the bearing (or marks the graphic angle) to the position occupied by the field observers; they also read the vertical (or mark the graphic) angle to the same position, which readings they record as *A*, 1 horizontal and *A*, 1 vertical. As soon as convenient, point No. 2 is observed in an identical manner, and is recorded as *A*, 2 horizontal and *A*, 2 vertical; and so on throughout the entire series. After making all of the '*A*' observations, the observers move to the other end of the field to be covered, and complete a set of '*B*' observations; after which it may be advisable to make another set of '*C*' observations, or even more, to check the more important enemy positions.

For this kind of work, the principal calculations involve the tangent function. In calculating traverses without tables the sine and cosine series can be developed by making $X = O$ in each successive differentiation. Applying the same principles, we can develop $\text{Tan } X = X + \frac{2}{3 \times 2 \times 1} X^3 + \frac{16}{5 \times 4 \times 3 \times 2 \times 1} X^5 + \text{———}$, which result can be obtained by algebraically dividing $\text{Sin } X = X - \frac{1}{3 \times 2 \times 1} X^3 + \frac{1}{5 \times 4 \times 3 \times 2 \times 1} X^5 - \text{———}$ by $\text{Cos } X = 1 - \frac{1}{2}X^2 + \frac{1}{4 \times 3 \times 2 \times 1} X^4 - \text{———}$.

We can demonstrate that, for an accuracy of one in ten thousand, $\text{Tan } X = X$ up to 1° 15′; the numerical value of X being 0.0002909 times the number of minutes. Between 1° 15′ and 3° 45′ add 0.0001 to the numeric value of X for the exact value of the tangent. Between 3° 45′ and 10° 30′ $\text{Tan } X = X + \frac{1}{3}X^3$; and between 10° 30′ and 14° 30′, $\text{Tan } X = X + \frac{1}{3}X^3 + 0.0001$. Beyond 15° this formula is not of much value. The formula $\text{Tan } X = \frac{\text{Sin } X}{\text{Cos } X}$ will always prove of service.

The next important formulas are $\text{Tan } (U + V) = \frac{\text{Sin } (U + V)}{\text{Cos } (U + V)} = \frac{\text{Sin } U \text{ Cos } V + \text{Cos } U \text{ Sin } V}{\text{Cos } U \text{ Cos } V - \text{Sin } U \text{ Sin } V} = \frac{\text{Tan } U + \text{Tan } V}{1 - \text{Tan } U \text{ Tan } V}$ and $\text{Tan } (U - V) = \frac{\text{Tan } U - \text{Tan } V}{1 + \text{Tan } U \text{ Tan } V}$.

From these formulas we can deduce $\text{Tan}(2U) = \frac{2 \text{ Tan } U}{1 - \text{Tan}^2 U}$; also $\text{Tan } (45° + U) = \frac{1 + \text{Tan } U}{1 - \text{Tan } U} = \frac{\text{Cos } U + \text{Sin } U}{\text{Cos } U - \text{Sin } U} = \sqrt{\frac{1 + \text{Sin } (2U)}{1 - \text{Sin } (2U)}}$, and $\text{Tan } (45° - U) = \frac{1 - \text{Tan } U}{1 + \text{Tan } U} = \frac{\text{Cos } U - \text{Sin } U}{\text{Cos } U + \text{Sin } U} = \sqrt{\frac{1 - \text{Sin } (2U)}{1 + \text{Sin } (2U)}}$. Finally, $\text{Tan } U = \frac{\text{Sin } U}{\text{Cos } U} = \frac{2 \text{ Sin } U \text{ Cos } U}{2 \text{ Cos}^2 U} = \frac{\text{Sin } (2U)}{1 + \text{Cos } (2U)}$, or $\text{Tan } (\frac{U}{2}) = \frac{\text{Sin } U}{1 + \text{Cos } U}$.

The choice of formula to be used will entirely depend upon circumstances; the minimum amount of work in calculation being the guide to selection.

As a working example of the application of the above formulas, assume that, from outside sources, the base-line has been determined to be S. 70° 30′ E., 6000 ft.; with a starting elevation of 2101 and a finishing elevation of 3320 feet.

The first base-line observer shows *A*, 1 horizontal, to be an angle whose altitude is 1.15 times its base. Write $\text{Tan } U = 1.15 = \text{Tan } (45° + V)$. $\text{Tan}^2 U = \frac{1 + \text{Sin } (2V)}{1 - \text{Sin } (2V)} = 1.3225$. From which, $\text{Sin } (2V) = 0.13886 = (2V) - \frac{1}{6}(2V)^3$. And $2V = 0.1393 = \frac{0.1393}{0.0002909} = 479′ = 7° 59′$, which makes $V = 4°$, and $U = 49°$. This makes the bearing N. 60° 30′ E. for *A*, 1 horizontal, which bearing can be read directly if the observer is in possession of a transit.

The second observer shows *A*, 1 horizontal to be greater than 90°, as turned from the base-line, with a supplementary angle whose base is 0.191 times its hypotenuse, from which $\text{Cos } U = 0.191 = \text{Sin } (90° - U)$

$= \text{Sin } V = V - \frac{1}{6}V^3$. From this, $V = 0.19214 = \frac{0.19214}{0.0002909} = 660' = 11°$, and $U = 90° - V = 79°$; making the original angle 101°, or a bearing of N. 30° 30′ E. for *A*, 1 horizontal, which bearing could have been read directly if the observer had had a transit.

Upon plotting these bearings (Fig. 4), scale the distance 11,780 ft. from the first base-line observer, and 9060 ft. from the second base-line observer, to the field observers. For practical purposes it will not be necessary to obtain these distances more accurately than can be obtained by a large-scale map. Since the elevations in a topographical map usually require more accuracy than the horizontal measurements, it will be advisable to enter calculations where true vertical angles are read; but, if graphic angles are taken, it will save time and be proportionally as accurate to obtain the elevations by graphic means.

As I wish to explain the application of the formulas, I will assume that the first base-line observer obtains a reading by clinometer for *A*, 1 vertical of + 16°; and the second observer a reading of + 13° 30′.

For the first calculation: Tan 16° = Tan (45° − 29) $= \sqrt{\frac{1 - \text{Sin } 58°}{1 + \text{Sin } 58°}}$. Sin 58° = Sin (60° − 2) = Sin 60° Cos 2° − Cos 60° Sin 2° = $\frac{1}{2}\sqrt{3}(1 - \frac{1}{2}\text{ Sin}^2 2°) - \frac{1}{2}$ Sin 2°; and Sin 2° = 120 × 0.0002909 = 0.03491, making Sin 58° = 0.866 (1 − 0.00061) − 0.01745 = 0.84802; giving Tan 16° = $\sqrt{\frac{0.15198}{1.84802}} = 0.28677$. Multiplying, 11780 × 0.28677, we find 3377, which makes the elevation of the field observers 2101 + 3377 = 5478 ft. Another way to make this calculation would be Tan 16° = $\frac{\text{Sin } 32°}{1 + \text{Cos } 32°}$; Sin 32° = Sin (30° + 2°) = Sin 30° Cos 2° + Cos 30° Sin 2° = $\frac{1}{2}(1 - \frac{1}{2}\text{Sin}^2 2°) + \frac{1}{2}\sqrt{3}$ Sin 2°; Sin 2° = 0.03491, making Sin 32° = $\frac{1}{2}$(1 − 0.00061) + 0.866 × 0.03491 = 0.52993. Cos 32° = Sin 58° = 0.84802, giving Tan 16° = $\frac{0.52993}{1.84802} = 0.28671$.

As a check against this *A*, 1 position of the field observers, the second base-line observer obtains a clinometer-reading for *A*, 1 vertical of + 13° 30′. Tan 13° 30′ = Tan 810′, or *X* = 810 × 0.0002909 = 0.235629; and Tan *X* = *X* + $\frac{1}{3}X^3$ + 0.0001 = 0.235629 + $\frac{1}{3}$(0.235629)³ + 0.0001 = 0.24009. Multiplying 9060 × 0.24009 we obtain 2175 ft., which makes the elevation of the field observers 3320 + 2175 = 5495 ft., as compared to the former calculation of 5478 ft. If 5486 ft. be called the mean elevation of the field observers it will be as close as can be expected from this kind of work.

Assume that the first base-line observer obtains a bearing of N. 15° W. for *B*, 1 horizontal; and that the second base-line observer obtains a bearing of N. 45° W. to the same position. Plotting these bearings, we find the distance from the base-line observer to the field observers to be 5170 ft., and the distance from the second base-line observer to the field observer to be 9890 ft. Also assume that the first base-line observer obtains a clinometer-reading of + 17° for the value of *B*, 1 vertical.

Since the value of Tan 16° has already been determined, take Tan 17° = Tan (16° + 1) = $\frac{\text{Tan } 16° + \text{Tan } 1°}{1 - \text{Tan } 16° \text{ Tan } 1°}$.

The mean value of Tan 16°, from the former determinations, is 0.28674. Tan 1° = Tan 60′ = 60 × 0.0002909 = 0.01745, making Tan 17° =

$$\frac{0.28674 + 0.01745}{1 - 0.28674 \times 0.01745} = 0.30569.$$

Multiplying 5170 × 0.30569, we find 1580 ft., which makes the *B*, 1 elevation of the field observers 2101 + 1580 = 3681 ft. As a check against this elevation, the

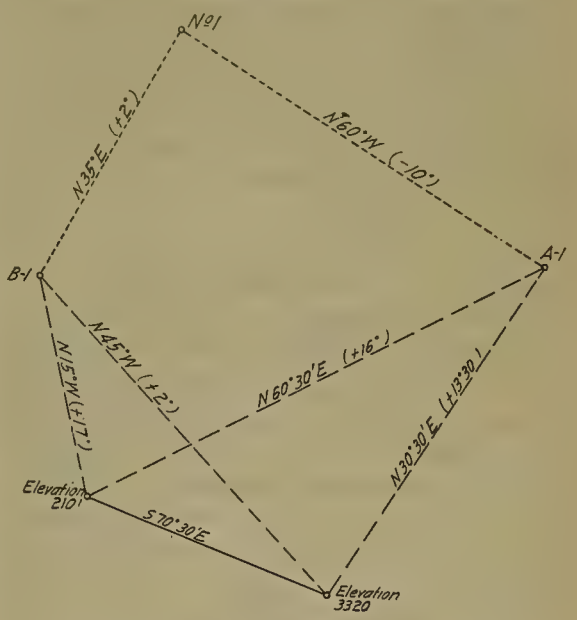


Fig. 4

second base-line observer obtains a clinometer-reading of + 2° for B, 1 vertical. Tan 2° = Tan 120′ = 120 × 0.0002909 = 0.03501.

Multiplying 9890 × 0.03501, we find 346 ft., which makes the *B*, 1 elevation of the field observers 3320 + 346 = 3666 ft., making an average elevation 3673 feet.

Also assume that, either by compass-reading, or from graphic angle, the field observers obtained a bearing of N. 60 W. to point No. 1, as their *A*, 1 horizontal, and in like manner, a bearing of N. 35 E. to point No. 1, as their *B*, 1 horizontal. Plotting these bearings, scale 9060 ft. from *A*, 1 to point No. 1; and 6520 ft. from *B*, 1 to point No. 1. Also assume that the field observers obtain a clinometer-reading of −10° for their value of *A*, 1 vertical. Then Tan 10° = Tan 600′ = 600 × 0.0002909 + $\frac{1}{3}$(600 × 0.0002909)³ = 0.17631. Multiplying 9069 × 0.17631, we find 1597 ft., which indicates an elevation for point No. 1 of 5486 − 1597 = 3889 ft. As a check on this elevation, the field observers obtain a clinometer-reading of + 2° for their value of *B*, 1 vertical. Tan 2° = 0.03501, from the former calculation. Multiplying

6520×0.03501, the result is 228 ft., which indicates the elevation of point No. 1 to be $3673 + 228 = 3901$ ft., which makes 3895 the mean elevation of point 1.

As I do not wish to complicate Fig. 4, I will not show the position of point No. 2, but will assume that it is down a straight hill from point No. 1, and that its position and elevation are determined in a manner identical to that used for point No. 1. Suppose the map that has been constructed shows that point No. 2 is 2000 ft. from point No. 1, and at an elevation of 3455 ft.; then the drop of the hill will be $\frac{440}{2000} = 0.22$ ft. vertical for each one foot horizontal, and we can interpolate contours as in making an ordinary topographical map. Any number of points can be determined, and the whole map completed without introducing any new principles. For important positions, such as enemy batteries, it would be advisable to take three or more complete sets of readings. As an example, suppose, for point No. 1, a $C:D$ and an $E:F$ set were taken in addition to the $A:B$ set already figured. The natural errors in this kind of observation will cause the respective position of point No. 1 to be at the corners of a small triangle. If we take the centre of the triangle as the true position of point No. 1, and the mean of the three elevations as the true elevation, it is probable that we will have an accurate estimation of the true position and elevation of this point.

A practical application of the outlined principles will prove useful. I have taken topography across a gulch by bearings and vertical angles from the side on which I was working, and have obtained quite satisfactory results. The calculations without tables are a practice worth attempting, as it gives an engineer a familiarity with the trigonometric functions such as he can obtain in no other way. After extracting a few cube roots, the extraction of a square root seems a simple problem; and, after working for a while without the use of any reference tables, it seems like 'taking candy' to go back to work with ordinary 'log-tables' and traverse-tables. In time of war, I consider that an engineer should know sufficient chemistry to be able to make a rapid test for the ordinary toxic gases and should know the antidotes for them; he should know sufficient geology to estimate the rock-structure of a hill from its surficial indications; should be enough of a mechanic to armor a car by bending old rails around a motor-truck; and should know sufficient mathematics to be practically independent of tabulated data. Though many of us can never expect to reach even part of these requirements, practice along these lines will prove worth an engineer's time, even if he never enter the military service.

Silver, in a baggage-car of one of the Indian railways, was recently scattered over some distance of the track. The car caught fire, melted the bags of new rupees (1 rupee = 34 cents), and the silver trickled through onto the line. The total amount of metal in transit was 20 lacs of rupees, equal to about $650,000. Natives were sent to recover the precious metal.

Production of Sodium

Sodium sulphate, in the form of salt-cake, is formed when hydrochloric acid is made from common salt by means of sulphuric acid. At least 183,909 tons of salt-cake, valued at $2,987,641, was marketed in the United States in 1917, according to statistics compiled by R. C. Wells, of the U. S. Geological Survey. This quantity indicates the production of at least 104,000 tons of 35% hydrochloric acid if nitre-cake was used, or of 270,000 tons of hydrochloric acid if sulphuric acid was used in its manufacture. Salt-cake is used in making glass, for the best grades of which it must be as nearly free from iron as possible. Material of the quality required is produced either in lead pans, or crude salt-cake is dissolved in water and re-crystallized in the form of Glauber salt, which is separated from the impure solution and converted by drying into glass-maker's salt-cake. The sales of Glauber salt in 1917 amounted to 47,757 tons, valued at $732,403. The sale of a small quantity of crude natural sodium sulphate in 1917 gives promise of the development of a new industry.

Nitre-cake, the residual product in the manufacture of nitric acid from sodium nitrate, differs from salt-cake in containing a large amount of sodium-acid sulphate, or bi-sulphate. The quantity of nitre-cake made in the United States in 1917 was large, owing to the great demand for nitric acid for making explosives. Most of it was probably never marketed. The nitre-cake marketed in 1917 amounted to 387,821 short tons, valued at $780,278. This quantity would require only 316,000 tons of sodium nitrate, whereas the Department of Commerce reports the importation for consumption of 1,725,165 tons of sodium nitrate from Chile in 1917. The difference between these figures may be partly accounted for by the consumption of nitre-cake in making hydrochloric acid and sodium sulphide, which would not, however, require more than 136,000 tons of sodium nitrate, leaving still a large difference to represent either nitre-cake not utilized or sodium nitrate that went into fertilizers or was stored for future use. Many uses have been proposed for nitre-cake, which could probably be obtained in quantity for about $2 per ton.

When nitre-cake is heated with salt, hydrochloric acid is produced and salt-cake remains, but if coal is also present the residue is sodium sulphide instead of sodium sulphate. Sodium sulphide is used in dyeing, in making dyestuffs, in tanning, in cleaning fabrics, in processes of ore flotation, and in precipitation of silver from cyanide solutions. A pure product containing water of crystallization is prepared by re-crystallizing the crude salt, much as Glauber salt is prepared, but for transportation and preservation a more concentrated, nearly water-free salt is used.

The total production of sodium sulphide in 1917 was 49,449 tons, valued at $1,905,263. This includes 36,078 tons of single-strength solution (30 to 32%), valued at $1,073,181, and 13,413 tons of double-strength solution (60 to 62%), valued at $832,082.

HOUGHTON, MICHIGAN

Labor Shortage.—North Lake and Lake Mines.

Labor continues to be the most important problem in the 'Copper Country.' Men are continually leaving the district, most of them to enter the Service, although a good many go to Detroit, where they are attracted by the high wages paid, and where they are unacquainted with local conditions. At no time during the past 15 years, excepting during the strike of 1913, has there been such a limited number of underground men here. There is no complaint about wages, which are the highest ever paid here; and no complaint about living conditions, which are good. The general feeling of unrest is the cause of the present labor situation. The mining companies are doing everything possible to replace the men by power and labor-saving devices, but in spite of this the copper output for the remainder of the year, and for the period of the War, will be abnormally low. Ahmeek is the only mine in this district that has all the men it requires at present.

Of the various Edwards' properties on the south range—the South Lake, Indiana, Algomah, and North Lake—the last-named is the only one in operation. Shortage of labor and the difficulty of keeping men at work at small isolated mines made necessary the shutting-down of the others. At the North Lake, work is confined to two openings, which now look well.

Although the Lake mine did not quite meet expenses during the last fiscal year, its condition is improving, there being a good increase in ore output, with better copper content.

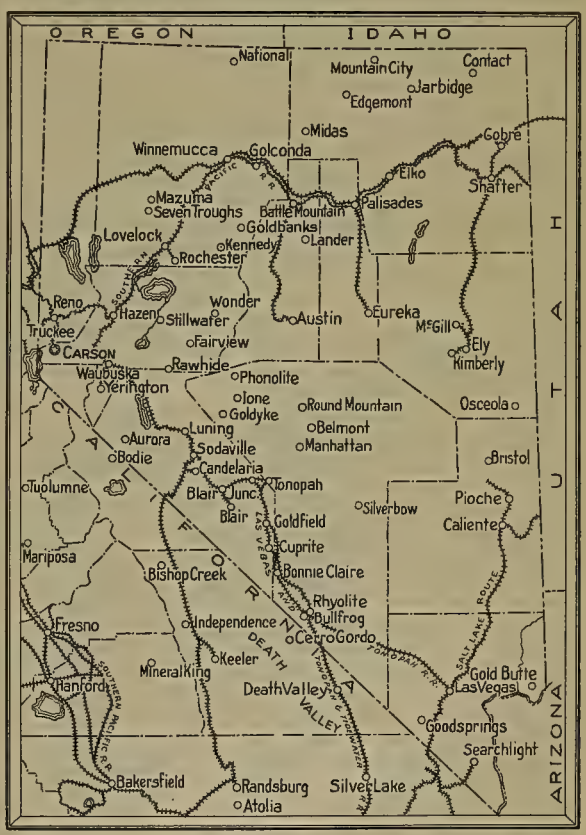
Calumet & Hecla is rapidly driving drifts to be used in the central hoisting scheme. On the Osceola lode the company has 20 electric locomotives employed in tramming. More are to be procured. C. & A. and its subsidiaries are very short of men.

RENO, NEVADA

Gold and Silver.—Divide District.—Goldfield Leases and Tailing Treatment.—Nevada Wonder Mine.—Eureka, Unionville, Pioneer, and Round Mountain Doings.

According to many of the larger operators, gold mining in Nevada is facing extinction if the Government does not aid the industry. Practical results from the American Gold Conference, held here recently, are not expected before four or five months time, and mine-owners generally do not regard with optimism the prospects for legislation that will bring them any concrete benefits. Most of the silver mines of Nevada, including those at Tonopah, are also producers of gold; and would be affected appreciably by any action designed to help gold mining. Silver producers are complaining of certain hardships, some contending that their mines yielded more profit when the metal was 50c. per oz. than at the present price, which is $1.01\frac{1}{2}$. This assertion is not borne out, however, after an examination of production and costs. Further, expansion in silver mining and marked contraction in working gold mines affords ample testimony to the superior condition of silver over gold mining. Silver mines that have greatly curtailed or suspended operations since the United States entered the War have been of recent origin and little developed. It is doubtful if they would have been successful enterprises even in normal times. On the other hand, a number of the producing silver companies are greatly extending development and planning larger production. Others, including the Nevada Wonder, Tonopah Belmont, and Tonopah Mining, and a few in other parts of the State, are developing mines under option to purchase, some as far distant as Central America and British Columbia.

Many gold prospects have been forced to close down, while most of the producers have reduced exploration to a mini-



MAP OF NEVADA.

mum, and there is little or no prospecting for gold in new territory. Inefficiency of available labor, no less than the shortage, has contributed to the difficulties of gold mining. The best miners have gone to the copper and silver districts, where higher wages prevail.

The Divide district, six miles south of Tonopah, is the most active of the new districts in Nevada. The Tonopah Divide, as has been mentioned before in these columns, promises great things. The ore is mainly silver-bearing, with some gold, while the upper levels showed an appreciable quantity of molybdenum. Various processes failed to

recover the latter metal, but gave an extraction of 92% of the precious metals by cyanidation. The ore is to be shipped to the Goldfield Consolidated mill. Electric power is now available and the Divide company is replacing its gasoline hoist by one driven by a motor. The walls of the almost vertical vein are well defined, and it is said that the ore can be handled at low cost. Other companies sinking shafts or developing in this district, none of which has yet exposed pay-ore in quantity, include the Brougher Divide, Tonopah Dividend, Divide Extension, Gold Zone, East Divide, Hasbrouck, Sutherland Divide, and Gold Reef. All have good equipment.

Goldfield is producing nearly $100,000 gross monthly, most of this coming from re-treatment of mill tailing by the Consolidated company. The Lidgerwood radial cableway is delivering 700 tons of this material daily to the mill. More than 60 leases are being worked in Consolidated ground. There are also a number at the Florence and other properties. Some of them are mining rich ore. The Red Hill Florence, Great Bend, C. O. D., and Blue Bull are the only other mines now producing. The Atlanta has exposed some copper-gold ore suitable for flotation, and is developing on the 1850-ft. level. Work is progressing at depth on the Grandma Consolidated, Kewanas, Spearhead, Silver Pick, New Jersey, and will be resumed shortly on the Cracker Jack, Black Butte, and one or two others.

At Wonder, the Nevada Wonder company has reached a depth of 2000 ft. Its mill is treating 150 tons daily, the best ore coming from between the 500 and 700-ft. levels. The Wonder mine has been one of the consistent dividend-payers of Nevada, and the manager, E. E. Carpenter, reports enough ore for many years treatment. The company has acquired the old Monitor Belmont mine, at Belmont, in northern Nye county, and pumps have been installed to unwater the old workings, which were 700 ft. deep. Between 1865 and 1880 the mine produced large quantities of rich silver ore, when costs were over $30 per ton. A flotation plant was erected in recent years to treat the tailing from the old mill, but tests indicate better results from concentration and cyanidation.

Eureka, one of the richest and most prolific of Nevada's bonanza camps, gives promise of a revival under development that is now being conducted on a broad scale for the purpose of re-opening the old mines.

Unionville, in southern Humboldt county, another early-day bonanza, is the scene of efforts to redeem a once famous mine. The old Arizona mine has been purchased from Neil Carmichael by the Sunset Mining & Development Co. It is being re-opened under the direction of F. W. Lockman, who is building a stamp-mill and putting in flotation equipment. Records of the Arizona mine show that following its discovery in 1862 it produced quantities of rich ore and 900 tons of selected ore, hauled by freight-team to Sacramento and shipped in sailing-vessels to Swansea, Wales. This netted the company $480,000. The vein is in blanket form, broken by a series of step-faults, and contains seams from 6 to 24 in. of rich ore. The ore carries silver, with traces of gold. A recent sampling supplied the basis of an estimate of 20,000 tons of 25-oz. ore available. Flotation tests indicate an extraction of 90 to 95%.

At Pioneer, 50 miles south of Goldfield, the Mayflower mine is being worked down to 400 ft. Milling ore of good grade has been exposed in considerable quantity, and the 10-stamp mill is working. The Reorganized Pioneer Mines Co., formerly the Pioneer Consolidated, has resumed development and will sink its 425-ft. shaft to 1000 feet.

In Jefferson canyon, near Round Mountain, the Jefferson Gold & Copper Co. has blocked out a large tonnage of ore, including some of high grade, in working through four tunnels. The flotation plant has not effected satisfactory recovery, and cyanidation will be resumed.

CRIPPLE CREEK, COLORADO

A. I. M. E. Visit.—Cresson, Stratton Estate, Leasing, and Drainage-Tunnel.

The American Institute of Mining Engineers and friends, 220 strong, visited the Cripple Creek district, coming by special train supplied by the Midland Terminal Railroad—A. E. Carlton, president—on September 4. The town was first visited. On the return to Victor a party of 17, headed by Dr. L. D. Ricketts, stopped off at Elkton and visited the Cresson mine, accompanied by Charles Noble, consulting engineer for the company. The main party stopped at Victor, where they were met by Frank Smale, manager, G. M. Taylor, and T. B. Crowe, and assistants, of the Portland company. Among the party were S. J. Jennings, C. W. Goodale, Robert M. Raymond, F. S. Cottrell, H. M. Evanson, S. L. Goodale, H. Foster Bain, George S. Rice, D. A. Lyon, W. R. Ingalls, E. P. Mathewson, Milnor Roberts, and Malcomb Muir.

Luncheon was served in a large tent erected near the Independence mill. Following this the visitors were shown through the plant or taken in autos to the No. 1 Portland shaft and through the mine. There was no formal speech-making. H. Foster Bain, of the U. S. Bureau of Mines, in an interview stated as follows: "I feel confident that something will be done for the gold camps after election. I am equally confident that nothing will be done in the way of allowing premiums on gold, or other steps taken prior to election. Congress has an immense amount of work before it in the form of legislation that must be disposed of before new legislation can be considered." Dr. Ricketts expressed the opinion that the "Cresson mine is today the richest gold mine in the world, and its rich deposits of gold ore will not be exhausted for many years to come." The visitors were taken to the 10th level, where a new and rich orebody is under development. A specimen presented to one of the ladies was fully 75% calaverite.

Net earnings of the Cresson for July amounted to $136,-054. Ore-reserves on August 1 are estimated as worth $3,055,708. Cash in bank is $1,025,133. An interesting feature of the July report is a shipment from the Roosevelt tunnel-level of 315 tons of $20.50 ore. The orebody from which it came is 50 ft. long on the dike.

Ten properties of Stratton Cripple Creek Mining & Development Co.—the American Eagles, Orpha May, Los Angeles, Six Points, and Longfellow, on Bull hill; Deerhorn, on Globe hill; Callie, on Gold hill; Nightingale, on Raven hill; New Boston on Womack hill; and the Keener tunnel dump, on Globe hill, are active under the leasing system. The first is the only one in which the company is directly interested. It is operated under the split-check system; royalties are paid by the others.

The August production from leased properties of the United Gold Mines Co. totaled 1785 tons, averaging $18 per ton.

A surface strike has been made at the New Boston, a Stratton Estate property on Womack hill. At a depth of 30 ft. the ore is rich. A trial shipment will be sent out the latter part of this week by the lessee, Abe Jones, a pioneer prospector.

At the annual meeting of shareholders of the C. O. D. Mining & Development Co. it was decided on a liberal leasing policy for the development of the C. O. D. mine in Poverty gulch.

The Roosevelt tunnel had 506 ft. of work done in the Portland and Cresson drifts during August, despite the labor shortage. The Portland drift toward No. 2 shaft was advanced 220 ft., and the two Cresson drifts 277 ft. The flow from the tunnel has fallen to 3000 gal. per minute.

The Independence mill of the Portland company is treating 1350 tons of $2.25 ore daily, at a cost of $1.11 per ton.

THE MINING SUMMARY

ALASKA

Juneau.—Alaska Gastineau in August treated 96,250 tons of $1.367 ore, with 82% recovery. This compares with 74,830 tons and $1.319 in July.

ARIZONA

Bisbee.—Copper output of the Phelps Dodge properties in August amounted to 17,101,261 lb. The total for 8 months is 149,000,000 pounds.

MILL OF MORENCI BRANCH OF PHELPS DODGE CORPORATION.

Chloride.—The Chloride Queen Mining Co. has just erected a 60-hp. gas engine, compressor, and pumps. There will be sufficient air for four jack-hammers. Development is under way on the 230-ft. level.

The Schuylkill Mining Co., has re-timbered the old Tennessee shaft and completed tracks on the 900-ft. level. Driving on this level toward the Schuylkill workings is under way. The ore in the face of the drift looks well. It is reported that the company has completed arrangements for the erection of a 250-ton mill.

Globe.—Old Dominion pays $1 per share on September 30. This makes $3 for the current year.

Jerome.—Copper production of this district in August was 12,000,000 lb.—7,500,000 lb. from the United Verde and the remainder from the Extension.

The suit of William Kemp et al. versus the Hull Copper Co. and Charles W. Clark, trustee, was brought to a sudden close and settled in the Superior Court of Yavapai county on August 30. A compromise was effected whereby Clark is to return to the treasury of the company 2,500,000 shares for cancellation, and is to have his title quieted to 5,181,173 shares still remaining in his possession. This gives Clark control of the Hull organization. The Hull company owns properties adjacent to both the United Verde and the Extension, and are considered to be valuable. It is stated unofficially that development will soon be arranged by the new board of directors.

Four headings are being worked on the 1080-ft. level of the Verde Combination, three of which are looking well.

The shaft at the Gadsden has been sunk 25 ft. below the 1200-ft. level for a sump, and a station is now being cut at 1200 ft. The ground is very soft and wet and difficult to work.

In diamond-drilling at the Calumet & Jerome in hole No. 4, which is being driven from a point near the winze on the 600-ft. level, the rods broke in two places, and it has been necessary to instal a larger machine to ream out the hole to extract the broken rods. The bore was down 215 ft. when the accident occurred in schist carrying considerable pyrite.

The work of sinking the Dorothy May shaft of the Green Monster has progressed steadily, a depth of 849 ft. having been attained. The formation at the bottom is diorite.

With the exception of finishing the station on the 900-ft. level of the Jerome Verde company's Maintop, everything is ready for shipment from the orebody on that claim. It is probable that by September 15 about 20 tons per day will be hauled by wagon to Clarkdale and shipped by the Santa Fe to the Consolidated Arizona smelter at Humboldt.

The Shea mine will probably be the next shipper in the Verde district. For some time it has been known that high-grade ore could be sorted from that being extracted from the drift running west on the level at the bottom of the 350-ft. incline shaft. The only thing that has delayed such action has been the desire to speed-up development. Inadequate equipment and lack of power has retarded greatly work at this property.

Kingman.—The Leviathan mine is shipping a carload of molybdenum concentrate monthly to its chemical plant at Los Angeles. This concentrate carries 16% MoS_2 and 16% Cu.

Miami.—Inspiration produced 9,000,000 lb. of copper in August. This is about 2,500,000 lb. below normal capacity.

The Miami Copper Co.'s August output of 5,374,000 lb. was a record. It was 600,000 lb. larger than that for July. The total for the eight months is 39,260,000 pounds.

Oatman.—The United Eastern company pays its regular monthly dividend of 5c. per share on September 26. No. 7 level of the mine is opening extremely well.

The Gold Ore has opened $20 ore on its 650-ft. level. After driving 60 ft. the vein widened to 27 ft. This is now to be blocked out. A. C. Werden is in charge.

The Record Lode shaft is down 433 ft., on its way to 500 ft.; $17 ore was opened on the 300-ft. level.

The Mossback and Oatman United continue prospecting.

Patagonia.—Recent tests made on manganese ore from the Mowry mine have been successful, and machinery for a concentrating plant has been ordered. There is said to be a large body of low-grade ore available.

It is reported that the Flux mill is now successfully treating 200 tons of complex ore per day from the Flux mine. The flow-sheet is said to be similar to that of the new mill of the Shattuck-Arizona at Bisbee.

Ray.—The Ray Consolidated pays 75c. per share on September 25.

Tombstone.—Three properties in the Huachuca mountains are now producing scheelite. They are the Huachuca Tungsten Mining & Milling Co., Sunny South, and Cave Man.

Tucson.—Bulletin 91 of the Arizona Bureau of Mines, by M. A. Allen and G. M. Butler, covers the manganese situation. The types of ore, deposits in Arizona, producers, uses, prices, and dealers are given. Manganiferous-silver

ore is found at Tombstone, Patagonia, Bisbee, Superior, Clifton, Morenci, Dos Cabezos, and near Globe. Several deposits of manganese have been worked in the Big Horn mountains, in the northern part of Maricopa county; and one in Yavapai county, in part of the Harcouvan mountains, near the Maricopa county line. Some promising deposits exist 5 miles north-west of Tappan ranch, on the Williams river, in Mohave county; but they are 45 miles from rail. There are 36 producers of manganase in Arizona.

CALIFORNIA

Amador City.—The Central Eureka Mining Co. has issued a circular reviewing the past three months work. Early in May there was not enough ore blocked out to supply 20 stamps for over two weeks. The shaft has since been deepened to 3555 ft. Below 3425 and 3500 ft. it is in greenstone. From the 3500-ft. station a south-west cross-cut at 45 ft., near the greenstone-slate contact, found the hanging-wall vein; 25 ft. farther on another vein was cut, and is now being followed. Above the north drift a raise is being driven to connect the 3400 and 3200-ft. levels. Stopes above this drift supplied most of the good ore during the past two months. A good deal of exploration has been done at other points. In addition to regular development, 30 men have to care for 6300 ft. of 3-compartment shafts. Three years ago, 60 men were employed at $2.50 per shift; while today 30 men receive $4. Carmen get $3.50. As the South Eureka had stopped work, in order to keep down water, the Central had to hoist it by skips in the South company's shaft, under agreement, until the Deane pump on the 2000-ft. level was repaired. The unexpected cost of pump repairs, etc., was $8000. Motor-driven pumps were installed at 2900 and 2700 ft. of the South Eureka, replacing air pumps. This will save the Central $150 per month. Bills for mine timber ($7500), for wire rope ($2500), and for pump crankshaft ($1200) have to be met at an early date. A disputed claim of $6000, made by the South Eureka, was settled by paying $3000, of which $2250 is due on monthly installments of $250. A note for $4000 is due the bank in October. The treasury contains $3559, and as banking accommodation may be difficult to obtain, an assessment of 2½ cents per share is to be levied. This will amount to $37,500.

Grass Valley.—For the disposal of tailing from its cyanide plant the North Star Mines Co. has erected an aerial tram 1225 ft. long. This enables the residue to be dumped above the east side of Wolf creek.

Plymouth.—The California Exploration Co., which is interested in the Plymouth Consolidated, paid a dividend of 12c. per share on August 20. The amount is $27,794.

Sonora.—It is reported that the drainage-tunnel of the Springfield company requires only 120 ft. for completion. Extraction of gold-bearing gravel is expected to commence in November. Some chrome is being developed in this district.

COLORADO

Breckenridge.—Dredging by the five boats in this district continues at full capacity.

The Iron Mask mine shipped rich gold-silver-lead (carbonate) ore last week.

Lessees at the Dunkin sent out 75 tons of 15 oz. silver and 45% lead ore.

The Silver King and other claims have been bonded to Senator S. Fincher.

The Wellington Mines Co. continues to make a regular output of zinc concentrate.

Rico.—The Rico Consolidated Mining Co. and F. B. Townsend have started suit against the Rico-Argentine Mining Co. for $900,000, alleging wrongful extraction of ore. The defendant considers that not more than $10,000 has been mined from the disputed ground, through which it has arranged to continue work pending the suit. The Rico-Argentine also claims apex-rights to the vein. The disputed ground is said to be in a portion of the plaintiff's Alleghany claim, which overlaps an older patented claim of the Argentine.

Silverton.—The new wage-scale for this district is as under, according to the 'Miners' Magazine' for September: Eight hours shall constitute a day's labor in and around the mines, mills, and smelters; $4.50 shall constitute a minimum wage. All classes working in wet places where rubber clothes are required, 50c. per day additional. For sinking and raising, 50c. additional shall be added. Pay-day twice a month. The scale of wages shall be based on $1 per day board.

Miners

Machine-men	$5.25	Mule-drivers	$4.50
Helpers	4.75	Nippers	4.50
Timber-men	5.25	Trammers	4.50
Helpers	4.75	Shovelers	4.50
Engine-men	5.25	Blasters	4.75
Station-tenders	4.50	Firemen	4.75
Blacksmiths	5.25	Hammer-men	4.50
Helpers	4.50		

Tramway Men

Oilers and linemen	5.25	Gripmen	4.75
Brakemen	4.75	Bucket-men	4.75

Mill-Men

Repair-men	5.50	Crusher-men	4.50
All operators	4.75	Roustabouts	4.50
Canvas-plant men	4.50	Flotation men	5.00

Telluride.—Ore and concentrate shipments from this centre in August totaled 102 carloads. The Tomboy dispatched 36, and Smuggler-Union 60, to smelters.

MISSOURI

Duenweg.—Thomas H. Noonan, of Webb City, formerly superintendent of the Wilson mine on the Boston-Duenweg, has secured a lease on 230 acres of land, including the Boston-Duenweg, the King Bill, and Royal, and is sub-leasing the ground to practical miners at a royalty of 15%. Mining was first done in sheet-ground at a depth of 250 ft., but on account of thin ore and low prices, work was unprofitable. The soft ground at 150 ft. is now to be mined. Hand-jigs are being used for cleaning the ore.

Joplin.—Production of the region last week was 9723 tons of blende, 95 tons of calamine, and 1493 tons of lead. These averaged $54, $40, and $100 per ton, respectively. Total value was $677,466, of which Missouri contributed $185,196. For 36 weeks the output is $17,420,875.

No. 3 mine of the A. W. C. company is the only property being worked in the West Joplin sheet-ground area. This ore carries a good deal of lead, which is very profitable to extract at present prices. Only one of its four mills is concentrating ore.

MONTANA

Butte.—Zinc in concentrate produced by Butte & Superior during August was 17,250,000 lb., compared with 11,500,000 lb. in July and June. The silver output was 220,000 ounces.

Anaconda produced 24,900,000 lb. of copper in August, 500,000 lb. less than in July.

East Butte yielded 1,714,358 lb. of copper in August, a decrease of 362,000 lb. when compared with July.

Troy.—The Snowstorm mill concentrated 5000 tons of ore during August. More men are expected after the harvest. No. 7 tunnel is in 900 ft.; the total length to be 2200 feet.

NEVADA

Carson.—High-grade manganese is being opened at the head of Brunswick canyon, near here.

Ely.—Nevada Consolidated pays 75c. per share on September 25.

Goldfield.—The Klondyke-Portland Co. has been formed

with the following officers: Peter Felis, president; M. F. Hill, vice-president; J. B. Witt and Mrs. Helen Rosenthal, directors; and J. F. Henry, secretary-treasurer. The property of 9 claims is in the Klondyke district, north of Goldfield. At different periods within the last 8 years three shafts were sunk, the deepest to 180 ft. Near the 55-ft. shaft, gold-silver-copper ore worth $60,000 was mined. An extension of this shoot is to be sought.

Luning.—The Kirchen Mines Co.'s property here has been sold at sheriff's auction to satisfy a judgment for $2168 in favor of the Luning Mercantile Company.

Manhattan.—The White Caps shaft is down 25 ft. below the 500-ft. level. Two shifts are employed. The mill is treating 110 tons daily.

The Union Amalgamated has had a change of management, W. B. Merton being superintendent. The mine is being sampled by W. Richardson and W. P. McCarthy.

The Thanksgiving Mining Co. is resuming work. Before being closed the mine was opened to a depth of 430 ft. The shaft is to be sunk another 100 feet.

Pioche.—A quarter interest in the Davidson manganese mine here has been sold by H. C. Hall of Las Vegas to the Prince Consolidated M. & S. Co. for $60,500 cash. This company now owns the property.

Tonopah.—The Midway company has cut 4 ft. of good ore 500 ft. south-west of the shaft, on the 600-ft. level. The vein indicates persistence. It was discovered by a raise being driven on another orebody.

The West End and Jim Butler companies have made a settlement in the apex suit. The proceeds of ore mined in the disputed ground—$400,000 held in escrow—is to be released. The West End gets this money; also the remainder of the ore. The August output was valued at $111,893.

NEW MEXICO

Mogollon.—Road improvement between this place and Magdalena is being done by convict labor.

Red Rock.—The Great Eagle fluorspar mine near this place is shipping four carloads weekly. Most of this goes to San Francisco. Chicago gets one car assaying 97.97 CaF_2. By certain work on the 100-ft. level it is estimated that 50,000 tons will be blocked out.

Santa Rita.—Chino Copper Co. pays $1 per share on September 25.

OKLAHOMA

Picher.—Production of the fields last week totaled 5681 tons of blende and 1213 tons of lead, valued at $430,350.

TEXAS

San Antonio.—Manuel F. Palacio of Saltillo, Mexico, representing Governor Espinosa Mireles of the State of Coahuila, has been sent to the United States for the purpose of interesting American capital in the development of extensive iron-ore beds, coalfields, forests, fibre, and other native products. It is stated that he has authority to offer liberal inducements in the way of concessions for foreign investments in these industries. Many of these resources are situated within 10 to 200 miles of the Rio Grande border. Mr. Palacio will visit St. Louis, Pittsburgh, New York, Chicago, Kansas City, Denver, Los Angeles, and other cities. In connection with coal mining, which was being carried on in Coahuila for several years up to the beginning of the revolutionary period, it may be stated that R. H. McCraken, of San Antonio, was the pioneer in that development. In 1878 he was manager of the Cedral silver-lead mines, and found bituminous coal outcropping there. He had some ovens built to make coke, used it successfully to reduce the Cedral ores; so starting the use of Mexican coal and coke. He examined the Santa Rosa valley and found bituminous coal in large quantities. Eminent geologists and coal men disputed his assertions, but Mr. McCracken was right.

UTAH

Bingham.—The Bingham Mines Co. pays 50c. per share on October 1. This is equal to $70,000, making $210,000 for the current year.

Utah Copper Co. pays $2.50 per share on September 25.

Milford.—The Majestic Mines Co. is cutting a station at 400 ft. The shaft is to be sunk to 500 ft. before prospecting starts. A. D. Moffat is manager. Lessees are mining rich copper ore at the O. K. end of the Majestic.

The Old Hickory is sinking a shaft in the open-cut, which produced a large quantity of copper-silver ore. In July, three cars of ore averaged $400 per car.

Park City.—Mines in this district last week shipped 1789

DALY-JUDGE MILL, PARK CITY, UTAH.

tons of ore. The Judge M. & S. Co. sent out 505 tons, with 135 tons of electrolytic zinc; the Ontario 519 tons of ore, the Daly West 138 tons, and Silver King Coalition 395 tons.

On October 5 the Ontario Silver Mining Co. pays 50c. per share, equal to $75,000.

Tintic.—The Liberal Manganese Mining Co. has been organized at Salt Lake City to operate 11 claims in the Erickson district. T. L. McCarthy is president. The ore carries from 25 to 40% Mn. It has to be hauled 28 miles to rail.

The Eagle & Blue Bell company pays 10c. per share on September 20. This amounts to $89,315.

WASHINGTON

Republic.—The Last Chance mine shipped 1500 tons of $12 gold ore to Trail during August. The deepest workings are at 500 ft. The shaft may be sunk later. Thirteen men and a foreman are employed.

CANADA

Quebec

The annual report of the superintendent of mines, Theo. C. Dennis, for this Province, for the year 1917, has just been published. The mineral production, including building materials, was valued at $16,266,480. This is an increase of $3,000,000. The minerals of most interest to Americans are as under:

Mineral	Men employed	Tons	Value
Asbestos	3,154	137,242	$7,198,558
Chromite	268	36,186	498,301
Copper and sulphur	311	122,822	1,205,242
Gold, ounces	21	1,116	22,570
Graphite, pounds	90	1,078,000	99,024
Magnesite	294	58,340	729,025
Mica, pounds	220	1,531,629	281,234
Molybdenite, pounds	289	226,739	238,096

All of these, save copper, showed a large increase in value over that of 1916. Asbestos producers pay the Government a royalty of 2% on the gross value of the mineral extracted. There were 14 producers. Some of the chromite in the above list—assaying from 12 to 30% Cr_2O_3—was sold by

miners to mills, where it was dressed to 45 or 50%. The Mutual Chemical Co.'s chrome mill consists of a 9 by 15-in. jaw-crusher, thirty 950-lb. stamps, crushing through 20-mesh, and seven Wilfley tables. Its daily capacity is 70 tons of 12% ore, concentrated to 50%. Most of the molybdenite assayed 75% MoS_2 and over. A great deal of exploration was done at the Moss mine of the Dominion Molybdenite Co., near Quoyon. From June to October, 12,000 ft. of diamond-drilling was done, with satisfactory results. The Wood flotation machines in the mill gave high-grade concentrate, but a low recovery. The Callow system was eventually installed in the 150-ton mill. The magnesite output includes raw and calcined material, equal to 64,000 tons of crude ore.

Ottawa.—Since July 1914 the Dominion Mint has received gold coin and bullion valued at $1,300,000,000. The refinery was greatly enlarged. The bullion received was 15,992,770 oz., yielding 14,048,803 oz. of fine metal.

CHILE

La Fundicion.—Cerro de Pasco produced 5,786,000 lb. of copper in August, 550,000 lb. more than in July, but 100,000 less than in June.

COSTA RICA

The report of the Abangarez Gold Fields of Costa Rica for the year 1917 has just been issued. The property is in the Guanacaste district. New York people, headed by M. C. Keith, own the mine. The past three years results show the following:

	1917	1916	1915
Ore treated, tons	62,934	50,221	25,262
Gross yield	$636,298	$670,574	$197,619
Average per ton	10.12	13.35	7.82
Total cost per ton	7.26	8.48	8.18
Interest charge per ton	1.08	1.57	3.11
Profit	$178,733	$244,951	$9,244*

*Loss.

Interest on loans, etc., reduced the 1917 profit to $110,-580. Current assets totaled $179,937 and liabilities $205,-978, including unpaid coupons $155,315. The notes payable total $1,143,248.

MEXICO

Mexico City.—According to a telegram of August 31 from the American Consul-General at Mexico City, a decree has been published granting exemption from import duty to all mining and industrial machinery from September 1. Such machinery was formerly dutiable at ₱0.02 per kilogramme, or $0.45 per 100 pounds.

Tamaulipas

Tampico.—A Consular Report states that declared exports of crude oil and petroleum products from the Tampico district to the United States in July 1918 amounted to 3,435,545 bbl. The movement from Tampico was 2,783,300 bbl., from Tuxpan 441,245, and from the new shipping point of Port Lobos 211,000 bbl. Shipments to points other than the United States during the same period were 1,309,290 bbl.—676,916 from Tampico and 632,374 from Tuxpan. Gross exports, therefore, reached a total of 4,744,835 bbl., a record month for the present year.

NICARAGUA

Bluefields.—The Eden Mining Co., a subsidiary of the Tonopah Mining Co. of Nevada, operating in the Pis Pis district, closed its 150-ton mill in March last, owing to a shortage of power. Additions to the water-supply will soon make available from 500 to 700 hp. more, giving a total of 1400 hp. The plant will then be started again. Mine development continues. The property is opened by tunnels. The Culebra vein has 500 ft. of backs, and the Eden vein 250 ft. The mill includes a ball-mill, ball tube-mill, and cyanide plant. Native labor is plentiful but inefficient. There were many difficulties in operating in this region, according to W. H. Blackburn, general superintendent, who recently returned to Nevada.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Hallet R. Robbins is here from Washington.

Albert Burch is expected back from Washington.

O. E. Monette, of Los Angeles, is here on a short visit.

H. H. Stout, Jr., of Douglas, Arizona, is at the Fairmont hotel.

H. A. Cohen is examining a mine in Plumas county, California.

C. L. Morgan was in San Francisco from Guadalupe de los Reyes, Mexico.

A. F. Keene (formerly Kuehn) has left London and is now established at 42 Broadway, New York.

S. R. Brown, mine superintendent for the Porphyry Dyke Gold Mining Co., has joined the 27th Engineers.

Todd C. Woodworth, formerly in Mexico, has enlisted in the 42nd Canadian Highlanders and is now in France.

Karl Eilers and **H. A. Prosser** are making their semi-annual tour of inspection of the A. S. & R. plants in the West.

Walter Hovey Hill has moved from Homestead, Oregon, to Boise, Idaho, after having spent three months visiting the mines of central Idaho.

K. A. Cunningham has been promoted from superintendent of the Guanajuato Development Co. to general manager at Guanajuato, Mexico.

J. M. Wadsworth, petroleum engineer for the U. S. Bureau of Mines, has been appointed efficiency engineer for the Fuel Administration in California.

P. M. Anderson, consulting engineer to A. Goerz & Co., now the Union Corporation, Ltd., is here from Johannesburg. He sails for South Africa on October 12.

John C. Greenway, general manager for the Calumet & Arizona, has been promoted to Lieutenant-Colonel and has been transferred, at his own request, from the Engineers to the Infantry of the A. E. F.

C. A. Rice is superintendent of the Oronogo Mutual mine near Joplin, Missouri, for the new owner, the Athletic Mining & Smelting Co. **Guy H. Warring**, previously in charge, is joining the Service.

Harrison E. Clement has recently been appointed general manager for the American Mining & Exploration Co., operating the Imlay and Rye Patch mines in the Humboldt district, Nevada, with headquarters at Imlay.

F. W. Bunyan delivered an interesting address on Brazil before the local section of the American Chemical Society on September 14. He has been appointed assistant chemist to the Noble Electric Steel Co. and will proceed shortly to Heroult, in Shasta county, California.

George E. Price died on July 24 at Charlotte, North Carolina, at the age of 60. For the three last years of his life he was engineer in charge of the Rudisill mine; previously he had been in many parts of the world, including Western Australia, West Africa, and Bolivia. His son, Ely R. Price, is sergeant in the American Expeditionary Force in France.

The Consolidated Mining & Smelting Co. of Canada has announced, through J. J. Warren, the managing director, that it will give a scholarship of $500 per annum, commencing next year, to the man standing first, among the families of its employees—the latter being restricted to those engaged at day labor—in his matriculation examination for an applied science course in the University of British Columbia. Further study that this grant will help pay for may be taken at this or any Canadian university.

THE METAL MARKET

METAL PRICES

San Francisco, September 17

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	16
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—9.30
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	12
Zinc-dust, cents per pound	16

ORE PRICES

September 17

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$25

EASTERN METAL MARKET

(By wire from New York)

September 17.—Copper is unchanged. Lead is scarce and firm. Spelter is quiet but strong.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

	New York,	London,
Sept. 11	101.12	48.81
" 12	101.12	48.81
" 13	101.12	48.81
" 14	101.12	48.81
" 15 Sunday		
" 16	101.12	48.81
" 17	101.12	48.81

Average week ending	
Aug. 6	99.62
" 13	99.62
" 20	100.25
" 27	101.12
Sept. 3	101.12
" 10	101.12
" 17	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	....
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Silver exports from San Francisco during August were as follows: to China, $5,826,559; to India, $9,900,151; and to Mexico, $242,166 (coin).

The Federal Reserve Board has decided to regulate more closely the outgo of silver from this country by preventing unnecessary exports. Heavy inroads on the stocks of silver have been made, resulting from the more liberal policy heretofore followed by the Board with respect to exports.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date	
Sept. 11	26.00
" 12	26.00
" 13	26.00
" 14	26.00
" 15 Sunday	
" 16	26.00
" 17	26.00

Average week ending	
Aug. 6	26.00
" 13	26.00
" 20	26.00
" 27	26.00
Sept. 3	26.00
" 10	26.00
" 17	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
Sept. 11	9.50
" 12	9.50
" 13	9.62
" 14	9.62
" 15 Sunday	
" 15	9.75
" 17	9.75

Average week ending	
Aug. 6	8.37
" 13	8.37
" 20	8.60
" 27	9.16
Sept. 3	9.42
" 10	9.41
" 17	9.62

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

Zinc-ore sales (60% metal) at Joplin last week were generally on a basis of $50 per ton.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date	
Sept. 11	8.05
" 12	8.05
" 13	8.05
" 14	8.05
" 15 Sunday	
" 16	8.05
" 17	8.05

Average week ending	
Aug. 6	8.05
" 13	8.05
" 20	8.05
" 27	8.05
Sept. 3	8.05
" 10	8.05
" 17	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

Lead ore (80% metal) is firm at $100 per ton at Joplin. Premium ore realizes $104.50.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date	
Aug. 20	120.00
" 27	120.00

Sept. 3	120.00
" 10	120.00
" 17	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

Two-thirds of the pig-tin supply of the world will be received by the United States, under a pooling arrangement made at a recent conference at London of representatives of America, Great Britain, France, and Italy. This is announced by War Industries Board. All shipments of pig-tin and tin ores to this country will be consigned to the American Iron and Steel Institute, which will distribute it at regulated prices to the consumers.

ORES (New York)

Antimony: Again there is no news in this market.

Ferro-manganese: There are now five companies in the United States making ferro-manganese in electric furnaces—three on the Pacific Coast, one in Colorado, and one in Alabama. The Anaconda Copper Mining Co. will soon be a new maker on a large scale at Butte. Quotations are firm at $250 per ton, delivered, for 70% alloy, with $3.50 per unit added or subtracted above or below this level.

Molybdenum: More inquiry is appearing, and the market is more interesting, but quotations are nominally unchanged at $1 per pound.

Tungsten: There have been ready sales of high-grade ore as well as low-grade, the former going at $24.50 to $25.50 per unit, and the latter at $20 to $24. Ferro-tungsten is strong, one maker asking $2.50 per pound.

Eastern Metal Market

New York, September 11.

The markets are all quiet so far as buying is concerned, and the major ones are very strong.

The labor situation is the serious factor in copper, both in the output of crude and refined.

Tin is very quiet and continues to fall gradually. The trade is much interested in the possibility of an Inter-Allied Tin Executive Committee to sit in London in control of the world market.

Lead is still very scarce and under voluntary control.

Zinc is not active but is firm and higher. The tone is strong.

Antimony is quiet and steady.

The vast scale of the plans for the offensives in France appears in calls for more steel each week. Barbed wire to the extent of 34,000 tons has just been distributed from our own Government, and France wants 22,000 tons. An indication of the enlargement of the munitions program is found in the placing of 10,000,000 additional shell forgings in the Cleveland district. A re-assurance pervades the steel trade that the pending draft will not interfere with essential industries. Preparations for the meeting in Washington, September 18, next week, are engaging producers in various lines. Preliminary meetings are being held in New York this week, prominent among which is that of the pig-iron makers. Iron-ore interests will meet later. Advancing costs make the cases of those who are pressing for advances stronger than at any other time recently. Smaller producers are outspoken in calling for a separation of their case from that of integrated companies, but they are not ready to have the Government take over all output at differential prices.

COPPER

Undoubtedly the labor situation will control the destinies of the copper market of the future. While this phase of the industry is not critical just now, it is the cause of some anxiety on the part of producers, and the Government as represented by the War Industries Board. Production of both crude and refined metal is not as large as it should be, and this is blamed largely on the labor situation. The draft had deteriorated the kind of labor—perhaps not the number—but those replacing others called up are not as efficient or skilled. When the new draft is made effective, the result may be still worse. As copper is prominently a war industry, the regulation of the labor problem is vital to conserve the output of both refined and crude copper. Already it is estimated that the August output of refined copper was only 175,000,000 lb. This compares with 205,000,000 lb. in July and 215,000,000 to 220,000,000 lb. in the spring months. The statement is made that, because of the labor-shortage, the refiners are operating at only 75% of capacity. The output of crude copper is being found fault with in some quarters. The entire situation is full of possibilities, good and bad. The 26c. price for copper holds until November 1 when a revision is due, and some expect an increased price. For jobbing lots 27.35c. per lb. is the maximum price.

TIN

The most interesting news in this market in a long time is the unofficial and unconfirmed report that an Inter-Allied Executive Tin Committee has been established to sit in London to control the price and distribution of tin to the Allies. It is believed that this is one result of the present London conference to which Mr. Hughes, chairman of the Tin Committee of this country, went some weeks ago. The personnel of this committee, according to report, is to consist of two Englishmen, two Americans, one Chinaman, one Japanese, and one Hollander. Evidently it is the intention to bring under one control all brands of tin and to limit prices and profits. Thus far there has been no co-operation between the Chinese and the Dutch interests on the one hand and the interests of other producers. The market in general is dead. Prices continue to ease, and, while this is so, buyers refrain from showing any interest. There has been no business reported in the week covered by this review, and the sales in the last six weeks have been smaller than ever. The nominal price for spot tin is 83c. New York, while shipment from the Far East could probably be obtained at about 73c. per lb., as against 76.50c. a week ago. The price at the height of the upward movement some weeks ago was 97c. per lb. The London market also is still declining. Yesterday spot Straits was quoted at £343 10s. per ton, against £353 10s. a week ago. Deliveries of tin at all ports in August were large. The total for the month was 5953 tons, of which 3903 tons was received at Pacific ports, with 2050 at Atlantic ports. This total contrasts with 6782 tons in June. Tin in stock and landing August 31 was 715 tons. Imports of tin from January 1 to September 1, 1918, have been 42,414 tons, of which the Straits Settlements are credited with 23,323 tons. In the same eight months in 1917 the imports were 39,130 tons. The average quotation for spot tin in New York for August was nominal at 91.33c. per pound.

LEAD

There is nothing to be said about this market in addition to what has been reported in the past few weeks. The dominant factor is the scarcity of the metal, and there is still no relief in sight. The lead producers' committee, a voluntary organization, is closely controlling all sales and distribution, and not a ton can be sold except by their consent, so serious is the situation. Confidence is general and strong that the matter is being ably handled. The maximum prices laid down by agreement are 7.75c. per lb., St. Louis, or 8.05c., New York, for carload and larger lots, with less than carloads held at 8.55c. per lb., New York, above which dealers cannot advance their price. For less than one ton, 8.80c. is the price. These levels are considered fair. That they may be advanced in the future is possible, but there is no prospect at present.

ZINC

The temporary reaction, noted last week, has come to an end and the market seems to be in for a rise again. The tone is strong, with quotations firm, though largely nominal. Prompt and September prime Western is quoted at 9.25c., St. Louis, or 9.50c., New York, with very little metal being offered. Most producers and dealers, being comfortably filled with orders, are sitting tight, and are not anxious to sell at the present levels, not oven for more forward positions. It is evident that they look for higher levels soon. They base this on the probable purchase this week by the Government of 6000 tons of grades C and D zinc for delivery in the last quarter and on the fact that the weekly Government reports of this industry show little change or increase in stocks of any grade. For October delivery about 9.10 to 9.15c., St. Louis, is asked, and for the last quarter the quotation is 9 to 9.05c. Very few orders for any position are reported as having been booked in the last week.

It is stated that galvanized-sheet makers will ask for a higher fixed price because of the advanced cost of prime Western zinc.

Company Reports

AMALGAMATED ZINC (DE BAVAY'S) LTD.

Property: company buys zinciferous tailing from Broken Hill, New South Wales, mines and concentrates it by flotation.

Operating Officials: David Meredith, general manager; A. J. F. de Bavay, consulting chemist and metallurgist.

Financial Statement: for the half-year ended December 31, 1917, an operating profit of £20,214 ($96,000) was made. A dividend (No. 23) absorbed £25,000 ($120,000). Excess of current assets over liabilities is £149,040 ($710,000), exclusive of tailing paid for and shares in Electrolytic Zinc Co., Minerals Separation and DeBavay's Processes, Barrier Roaster Co., Zinc Investigation Co., and Zinc Producers' Association.

Flotation Operations: the plant worked about 70% of possible time, due to labor troubles. There was dressed 84,265 tons (equal to 800 tons daily) of material yielding 24,387 tons of concentrate assaying 48% zinc, 6.7% lead, and 8.6 oz. silver; also 928 tons containing 52.3% lead, 12.8% zinc, and 49.5 oz. silver.

The Electrolytic Zinc Co.'s first unit of 10 tons of spelter daily was started in January 1917, but enough power is not being supplied by the Tasmanian government. The electrolytic plant is to be enlarged to 100 tons capacity.

BROKEN HILL SOUTH SILVER MINING CO.

Property: lead-silver-zinc mine and works at Broken Hill, New South Wales, Australia.

Operating Official: W. E. Wainwright, manager.

Financial Statement: in half-year ended December 31, 1917, metals sold realized £269,933 ($1,296,000). Operations cost £116,089 ($557,000), leaving a profit of £153,844 ($639,000). Balance at end of June was £283,491 ($1,363,000), and at end of 1917 £317,553 ($1,524,000). The financial position is exceptionally strong.

Dividends: two absorbed £120,000 ($576,000).

Development: progress amounted to 3820 ft., 20 ft. being done on 1370-ft. level. Of ore broken, 95% was by contract. Ore-reserves are estimated as 3,500,000 tons.

Production: ore dressed amounted to 69,390 tons, assaying 14.9% lead, 7.1 oz. silver, and 13.7% zinc. Metal recovery from all processes—gravity concentration, flotation, and selective flotation—was 86.3% lead, 79.8% silver, and 80.5% zinc. Metal content of ore dressed was 10,356 tons lead, 491,561 oz. silver, and 9508 tons of zinc.

Costs: these totaled $7.54 per ton, mining costing $5, development $1.07, and concentrating $1.47 per ton. In the previous half-year costs were $6.65. The increase is mostly due to suspension of operations for 11 weeks through strikes. A new power-house is being erected, new electric hoist was installed at No. 3 shaft, and the Barrier Roaster Co. is erecting three De Sperlet furnaces to roast zinc concentrate for acid manufacture.

IVANHOE GOLD CORPORATION, LTD.

Property: one of the leading mines in Australia, at Kalgoorlie, Western Australia.

Operating Official: John McDermott, general manager.

Financial Statement: receipts in 1917 totaled £398,036 ($1,910,000). After paying for operations, taxes, depreciation, etc., there remained a profit of £106,092 ($509,000). The year started with a balance of £15,578 ($74,900), and ended with £7858 ($38,000). Investments are valued at £158,038 ($758,000).

Dividends: four absorbed £105,000 ($504,000), making £3,670,000 ($17,620,000) since 1899.

Development: to a depth of 3620 ft. vertical there was 3867 ft. of work done, also considerable diamond-drilling. Reserves blocked out amounted to 1,035,874 tons, averaging $8.20 per ton, a slight increase in tonnage, but decrease in value. This estimate is to the 2420-ft. level. Further sinking below 3635 ft. has been stopped pending discovery of pay-ore at and below 2720 ft. In February 1918, drilling west on the 707-ft. level, 9 ft. of $8.16 and 8 ft. of $7.44 ore was found. This is now being opened.

Production: the 100 stamps, grinding-pans, tube-mills, sand, slime, and concentrate plants treated a total of 233,719 tons of ore, yielding 91,403 oz. fine gold. This makes a total of 3,692,869 tons and 2,114,213 oz. since 1898. Extraction in 1917 was 87.29%.

Costs: these totaled $5.48 per ton, including $2.56 for underground work, and $2.20 for treatment.

Book Reviews

Metallurgists and Chemists' Handbook. Second edition. Compiled by Donald M. Liddell. Pp. 656. Ill., index. McGraw-Hill Book Co., New York, 1918. For sale by 'Mining and Scientific Press.' Price, $4.

Two years ago we reviewed favorably the first edition of this pocket-book. The new work has been revised and enlarged by the addition of 53 pages. A new chapter on organic chemistry—the common compounds—covers 7 pages. The section on alloys now includes chromium, ferro-manganese, high-speed steel, insuluminum, nickel and cobalt, non-corrosives, shell steel, and cast projectiles. Some data are given on the principal toxic gases, which the author says are given "because of the growing 'popularity' of the compounds in warfare." The chapters on chemical data; sampling, assaying, and analysis; cyanidation; and fuels and refractories have been added to slightly. The notes on flotation and cyanidation are practically as before. Metallurgists and chemists should find this a handy reference.

A Handbook of Briquetting. By G. Franke, translated by Fred. C. A. N. Lautsberry. Two volumes, each complete in itself. Vol. II, Briquetting of Ores, Metallurgical Products, and Similar Material; 4 plates, 79 ill., index. Pp. 214. Griffin's Metallurgical Series. J. B. Lippincott Co., Philadelphia, 1918. For sale by 'Mining and Scientific Press. Price, $4.50.

This is a brief but authoritative presentation of all the European methods in use today for the briquetting, sintering, and agglomeration of metallurgic products in preparation for further treatment. The special adaptations of the processes described are given in the text, and a valuable summary is provided in tabular form, classified as to method, name of originator of the process, and the principles applied in effecting the consolidation. The experience at various plants is given in terms that admit of working out the economies that may be obtained under different costs of labor and supplies. As indicated before, the treatise does not cover the distinctly American methods, the author apparently not having had access to the details. While this limits the scope, it nevertheless possesses the value of giving elaborate data concerning a great variety of methods not widely known in this country, and will therefore prove suggestive and stimulating to American engineers. It is interesting to note that an American practice of agglomerating fines and flue-dust with hot convertor or reverberatory slag, which originated simultaneously in several plants managed by American engineers about twenty years ago, is credited to a German. The book should make a wide appeal at the present time when conservation is so highly important.

INFORMATION FURNISHED BY MANUFACTURERS

THE FEDERAL SIREN

The Federal siren is an electrically operated sound-signaling device which has been developed to supply the demand for a sound-signaling apparatus in small towns, mining communities, factories, and the like. The electric siren has a distinctive sound that cannot be confused with any other kind; its peculiar tone graduating up and down the scale makes it effective and especially adapted to mine, mill, and smelter operations. It cannot be confused with engine, locomotive, and steam-whistles; it is penetrating and is different and unmistakable. Government cantonments, aviation fields, and shipbuilding yards are equipped with Federal sirens, as are also numerous mines and factories throughout the country. The Federal siren is operated by an electric motor contained in the siren itself, and is sturdily built to withstand all conditions of climate and weather. The throw of a switch, which can be in any convenient place to suit the purpose, is all that is necessary. The operation is instantaneous, starting with a low growl and gradually increasing to a shrill pitch and a wierd cry that cannot possibly be confused with any other whistle or signaling device. The Federal siren is manufactured by the Federal Sign System, Lake and Des Plaines streets, Chicago.

COMMERCIAL PARAGRAPHS

The National Carbon Co., Cleveland, Ohio, will build a new plant at Clarksburg, West Virginia, for the production of carbon.

The Electric Steel & Forge Co., East 61st street, Cleveland, Ohio, is considering the construction of a new plant at Newburgh Heights to cost about $200,000.

The Lakewood Engineering Co., manufacturer of construction plant and industrial haulage, announces the opening of new offices at Chicago in the Lumber Exchange building.

The Chas. T. Topping Machinery Co., of Pittsburgh, Pennsylvania, has merged its interests with the Pittsburgh office of the Lakewood Engineering Co., Cleveland, Ohio, manufacturer of construction plant and industrial haulage.

The Consolidated Refining Works, 201 Mulberry street, Newark, New Jersey, has filed notice of organization to produce and deal in metals. Samuel Johnson, 133 Elm street, heads the company.

The Globe Manganese Copper Co., of New York, has been incorporated with capital of $500,000 to operate manganese and copper properties. John Kasser, Edward C. Curnen, and Alexander L. Lindsay, New York, are the incorporators.

The Wheeling Pulverizing Co., Wheeling, West Virginia, recently organized with a capital of $25,000, is planning for the operation of a local mineral pulverizing works. S. J. Windsor and O. W. Leonhart, Wheeling, head the company.

The International Feldspar Co., Middletown, Connecticut, has disposed of its holdings at Maromas, near Middletown, to the New England Potash Co., Hartford, Connecticut. The new owner is planning for the erection of a 10-unit plant for the production of feldspar by-products.

A new blast-furnace with capacity of about 600 tons will be constructed by the **Phillips Sheet & Tin Plate Co.**, Weirton, West Virginia. It is also planned to erect new by-product coke-ovens; the battery will comprise about 45 ovens.

Armour & Co., Chicago, Illinois, are planning for the construction of a large plant near Columbia, Tennessee, for the production of phosphate. The mining plant, to be operated in the name of the **Armour Fertilizer Works**, is estimated to cost over $100,000.

The Crittenden Mining Co., of Marion, Kentucky, recently incorporated with a capital of $100,000, is planning extensive operations on fluorspar properties. Machinery for the initial works is now being purchased. E. G. Stribbling will be manager of the company.

The Lafollette Coal & Iron Co., Lafollette, Tennessee, has acquired a large iron-ore property near Sugar Valley, Georgia, and plans to install machinery and equipment to develop the land. The tract comprises about 1000 acres and immediate development will be undertaken.

New electrical machinery, mining screens, and auxiliary apparatus, coal-cutting machinery and other equipment will be installed by the **Black Raven Coal Co.**, Willard, Kentucky. The company is planning for a production of about 1000 tons of coal daily. W. H. Norris is general manager.

The Empire Metals Corporation, Gloucester City, New Jersey, has been incorporated with a capital of $500,000 to operate a metal-recovery works. Elmer J. Shinn, Gloucester City, Herbert L. Maris, Philadelphia, Pennsylvania, and William J. B. Roop, Kirklyn, Pennsylvania, are the incorporators.

Preliminary plans have been prepared by the **T. H. Symington Co.**, Rochester, New York, for a new ammunition works to be located at Chicago, Illinois. The plant will include a number of buildings and represent an aggregate cost of over $5,000,000. A. B. Austin, Cutter building, Rochester, is engineer.

The Standard Sulphur Corporation, Detroit, Michigan, will soon commence the operation of a new plant near Orla, Texas. The company has property consisting of over 4000 acres of sulphur lands in this vicinity and the new works will have an output of from 100 to 125 tons of refined sulphur per day. Alfred F. Pudrith, of Detroit, is president of the company.

The Union Smelting & Refining Co., Newark, New Jersey, has commenced operations at its new plant at Avenue L and St. Charles street. A large department has been provided for 12 furnaces for smelting and refining. The structure includes hydraulic-press department, mixing-room, and solder works. The new plant will produce babbitt metal, solder, and the like. The smelting and refining works will be used, in part, for the recovery of tin. The plant, when complete with machinery and equipment to be installed, will represent an investment of about $500,000.

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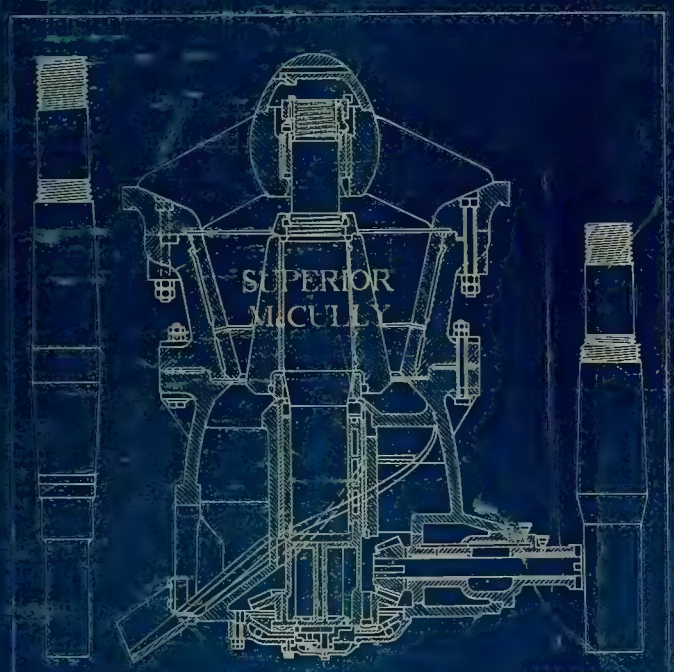

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COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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BY an oversight the article on 'Decanting' by Mr. H. Tillisch, published elsewhere in this issue, has not been credited as it should have been to 'The Journal of Industrial and Engineering Chemistry'. The suggestion is a useful one for operators in a laboratory, offering a simple means for hastening the settling of fine precipitates. The utilization of the same principle for settling pulp gives pertinence to the discussion.

CRITICISM is being made in Congress on the wasteful use of paper in the offices of the Federal Government at a time when publishers are being severely disciplined in this regard. The criticism is justified; we receive duplicates of Government bulletins and circulars; but other agencies for publicity are even more culpable; the postman brings us Crop Reports, Coal Mining Fabulities, and other matter that does not interest us in the least. Some of it continues to come after we have requested a discontinuance. At the present time the growth of publicity for all sorts of pseudo-war activities is immense, consuming recklessly a great deal of paper. We get all the scribbling-paper we need from such sources, using the back of the sheets, instead of consigning them to the waste-paper basket.

NEVADA is a great mining region, as we all know, but it is more than that, it is an intensely patriotic State; therefore it has become so angered by the tone of the Hearst press that the State Council of Defense has passed resolutions calling upon all news-dealers to abstain from selling "the Hearst publications" under threat of being "deemed guilty of disloyalty." Other counties and municipalities in Nevada, Oregon, and California have taken similar steps, and we rejoice to hear of them. It is high time for all good citizens to realize what a bubonic plague of journalism W. R. Hearst has brought upon the many communities in which he publishes his papers. These include ten newspapers, not to mention the defunct 'Deutsches Journal', which was discontinued on April 21 of this year; also seven magazines. According to the 'American Newspaper Annual and Directory' his newspapers have a total average daily circulation of 2,572,885, and his magazines a total average circulation per issue of 2,281,627. His influence for evil is potent and pestilential, so much so as to raise the question whether, in a democracy, it is not desirable to prevent any one man from controlling more than one paper, because the influence exerted by a man of poor character, by mere multiplication of the agencies for disseminating misinformation, is so great as to be contrary to the public good. Meanwhile, it is well that self-respecting communities should protest against the distribution of publications that poison the public mind and pervert the right thinking of the young, particularly in days like these when the Nation has committed itself to a great cause and a noble enterprise.

MR. GOMPERS seems to be leading organized labor more definitely than ever into constructive ways. Thus he shows how completely Germany miscalculated in her belief that labor would threaten our political stability and force acceptance of an inconclusive treaty of peace. This is so indicative of industrial peace, both internal and international, that we may overlook the doctrines that he preached only a few years ago. Likewise the French forgot and forgave M. Aristide Briand for hasty words spoken before he too had become one of the master-builders of a strong social structure. The more radical, who had not learned the value of social evolution as opposed to the wild dream of disintegrating society first and then trying to make it over according to schemes evolved from the finite wisdom of self-appointed reformers, dubbed M. Briand a conservative; likewise there are some who would apply that criticism to Mr. Gompers. As a matter of fact, authority and responsibility have taught both these leaders the value of centuries of social progress; they have discovered that there has not been lack of wisdom in the past, and that the laws under which we live and prosper may not be lightly cast aside. Law is the outcome of custom developed through the determination of men to live together co-operatively instead of retaining the prehensile tail that each may cling to his individual and personal tree. The British Labor Party gave all believers in our civilization a severe jolt when it adopted a platform that meant the discard of things as they are and the substitution of a new and untried system of ultra-collectivism. Mr. Gompers, however, visits England, and the Inter-Allied Labor and Socialistic Conference, a convention of workers in Great Britain and the United States, under his inspiration accepts the

principles of the French socialists in place of the extreme radicalism of the 'Platform of the Four Pillars.' The social doctrines proposed in the new resolutions admit of rational discussion because they rise to the level of principles that conceivably may be capable of international application. This is not to say that we accept them as they stand, but we recognize that they include material that may enter into a social foundation. That is what the world is seeking. For example, it is proposed that the treaty of peace should contain new definitions of civic rights, among which are these: The labor of a human being is not a commodity nor an article of commerce; involuntary servitude is not permissible prior to conviction for a crime; child labor shall taint the product as contrabrand; the basic work-day shall be limited to eight hours. The common factor in all these is the element of wholesome personal service as the expression of the individual will in a creative effort, to be rated above the concrete commercial result of labor. There is something to be said for that. It is the cornerstone of a philosophy that, incidentally, was involved in the doctrine preached in Palestine nineteen centuries ago, but was not always interpreted rightly. The principle and the practice need to be harmonized with skill and wisdom. We may anticipate the growth of right thinking and clear seeing when social principles so essentially constructive are substituted for those that mean the subversion of all the individual habits and predilections that have come down to us by instinct and inheritance.

ON September 19, Mr. J. R. Geary gave an interesting talk on Japan before the Engineers Club of San Francisco. The speaker had lived in Japan as representative of the General Electric Company for 15 years, and was well qualified therefore to give first-hand information. He did it in an agreeable and convincing manner. Mr. Geary took pains to disabuse his hearers of the insinuations against Japan circulated by German propagandists and by a certain group of disreputable papers in the United States. He laid stress on the fact that the trade relations of this country with Japan were such as to promote a friendly exchange and that the political aims of the two countries were concordant. His own experience in joint business with the Japanese had been most satisfactory, whether as the representative of a minority or a majority interest in corporate undertakings. The Japanese, he said, were astounded at the spirit shown by the United States in the War, by the idealism of motive and the effectiveness of action exhibited by our people; they admired these manifestations of the national morale and were heartily in sympathy with us. Much as they might, and did, admire the German military performance they reprobated the manner in which the Germans waged warfare, having themselves ideas on 'playing the game' a good deal like ours. Japan relatively is a small country lacking in the raw materials of manufacture but inhabited by a clever, energetic, and ambitious people; no need exists for friction or misunderstanding with our people, provided the German propagandist is prevented from misrepresenting the facts. We share Mr. Geary's belief that the Pacific Ocean will be true to its name and serve to promote friendly dealings between the United States and Japan, if only pro-German mendacity be silenced.

Chrome

On September 23 the War Industries Board issued a statement saying that "a new survey of the chromite situation meeting this week gives every indication that the tonnage of domestic chromite produced during the balance of this year can be sold at the average price prevailing this summer; if unable to find a ready market for ore wire this office giving tonnage and guaranteed analysis and price." Moreover, we understand that the plan adopted by the War Industries Board is to ensure a production for the first eight or nine months of 1919 at the same rate as during the corresponding period of 1918. There is nothing in the outlook to justify putting new capital into the business; in short, those that have proceeded to mine chromite under Government guarantee will be protected; that is all. We defer further comment, but we will say this: it is evident that the representatives of the Government have been placed in an awkward position by the greed of those in the ferro-alloy industry and that the making of money by them has been allowed to check the effort to stimulate the production of a mineral needed for the successful waging of the War. It is quite evident that a real War Minerals administrator is urgently required.

Killing the War Minerals Bill

Reports from Washington indicate that the House may agree to the so-called War Minerals Bill in the emasculated form in which it has issued with the inprimatur of the Senate. The man in the country is superciliously informed these days by the man at Washington that he knows nothing of the real needs of the Government, and the implication is that unless the superlative wisdom of the great Washington hive be conceded there is likelihood of being stung for our disagreement. We are not prepared to say that the Henderson substitute for the essentially sound and democratic Bill that was passed by the House will fail to supply the Government with all the manganese, chrome, tungsten, sulphur, and other minerals that it needs. Quite likely, to judge by the excellent way things are being done at the front and on the seas by the competent part of our national organization, to wit, the Army and Navy, the supply of these minerals, even in the haphazard fashion of committee administration, may prove sufficient to keep us from absolute embarrassment. There was a time when the country was alarmed by the reports from Washington; when every man was urged, as a patriotic duty, to get out and dig manganese, to scour the serpentine hills for chrome, to go into the gulches and wash gravel with a special eye to

recovering platinum. The people responded: they felt that they were doing a service equivalent to buying Liberty Bonds or making donations to the Red Cross when they flung their money into prospecting for these minerals at the behest of Uncle Sam. They expected, of course, that it meant so much to him that he would protect them against the wastage of their time and money. To put five thousand dollars into a manganese mine because the Nation needed the manganese and then have the Nation decline to accept his product at a price that will permit him to mine and ship it, is precisely like the urging of people to raise potatoes and beans, and then to leave them unprovided with either transportation or market after they have made their patriotic answer with work performed. It is not the sacrifice that hurts so much as the utter indifference to the fruit of the service. A man would have felt that he was really helping, like a good soldier, to whip Germany, if Uncle San had hauled off his potatoes to feed the Army, though he might have left only a due-bill in his hands, to be paid at the whim of some future Congress; but to be told to raise potatoes and then see them rot in the soil stirs bitter thought. When you waste a man's service you do worse than rob him. The same sort of thing has happened in the mineral industry. There was a veritable panic at Washington to release ships, and therefore to hurry the development of our own mineral deposits so as to relieve us from dependence upon foreign resources. The response was prompt and generous. It was the most speculative kind of mining that the people were asked to undertake; some achieved a modest financial return; most have lost money; and the promised bill to guarantee their market, in which they found encouragement to go on, has now been smashed. They had reason to expect that the bill would be amended, but not that it would be thrown overboard and a radically different one introduced that favors only the rich, and, in its operation, keeps the poor man from obtaining an outlet for his ore. To inspire a man to produce anything, potatoes, chrome, beans, or manganese, and then leave him without means to market it, is economic waste. The money had better been given to the Red Cross, where it would have done some good; the man's service had better been commandeered for building ships, so that he really would have helped to send soldiers across the seas to strengthen the battle-line. Under the Henderson bill a man must first interest a bureau or administrative committee, or whatever official the President may choose to subrogate for his official person in contracting for the output of a mine, or in arranging to take it over to be operated on some basis for compensation by the Government. The Bill was printed in full in our issue of September 14. Some of the Senators, realizing that it might be difficult and expensive for the ordinary prospector away off in the Sierra Nevada to go to Washington and wait around the hotel lobbies until he could obtain audience with those appointed to administer the Act, suggested that a bureau be established somewhere west of the Mississippi for the greater convenience of the miners. Even so, it interposes a bureau between the citizen and the Government that he wants to serve. There is nothing that the plain democrat hates worse than bureaucracy, because it is not democratic. The House bill was essentially a people's bill, for the good of the people and the Government that they create; the Henderson bill is for those that can get the ear of bureaucrats. If the House wishes to demonstrate that it is a truly representative body, it will reject this mere pretense of a war-minerals bill sent to it from the Senate. We may as well have no bill at all; it were better to leave the whole business in the hands of the War Industries Board. If we really need a great increase in the output of the minerals mentioned in the bill, then we require a measure that will enable the host of willing prospectors to produce and ship their ores; if we do not, then the passage of this bill, which admits of exclusive contracts at agreed prices without affording a competitive market, is to be condemned for the abuses that are possible under its terms. If we do not need to stimulate the industry, then it is evident that the powers vested in the War Industries Board are sufficient for providing the mineral products needed by the Government.

German Chemistry is Not German

Many years ago an American youth wrote to Dr. H. A. Green, then eminent as a lecturer on geology in the University of London, asking advice regarding a technical course, either in England or in Germany. The reply was significant: "Stay in America; you can get as good an education there as anywhere in the world, unless it be in France; above all, don't be misled by the boasts of the Germans; they give a finished course but not a developing one." The prime defect in the German character is revealed by Dr. Green's criticism: they do not originate. From the earliest times the Teutons have been ready to adopt the science of the nations whom they strove to conquer. During the centuries when the barbarians were pressing upon the cultured nations of the South, they were accustomed to send their sons to be educated at Rome, and the Romans, believing that the spread of civilization would promote the peace of the world, welcomed and coached them. The invasions that followed show that ideas of culture and development never penetrated their minds; that their use of Roman culture was merely to give them conquering power. Quickly the medieval and modern Germans learned the secrets of Nature from the Italian physicists, from the French and English chemists, but instead of seeking new understanding by which man might control the forces of the universe, they proceeded to develop intensively the commercial application of science for control of the world. Their students thronged the schools of France until they thought they had mastered the fundamentals. Pure science has never been their beacon; it was only the glitter of gold and the attraction of world dominion that led them on. Among them is no counterpart to a Dalton, a Faraday, a Gay-Lussac. We have mentioned before the striking fact that no German has discovered a single fundamental law of

science. On another page we reproduce a notable article by Mr Townes R. Leigh, reviewing the development of the natural sciences, and showing how completely Germany has borrowed her chemistry from the progressive nations now allied for defence against her as their common enemy, convinced that the safety of civilization necessitates the destruction of this inveterate Teutonic marauder. The work of four years has shown that even while distracted by the scramble of preparation for war, the French, the English, and the Americans have been able to advance the practical application of chemistry almost as far as the Germans had done in decades of quiet research. We and our Allies have declared independence of the German universities, and henceforth will teach the arts as well as the sciences in a spirit far different from that of the materialists of the North. The whole trend and purpose of civilization is toward a spiritual uplift, and the gross uses of science, in the hands of the Germans, lacked that quality utterly. It is under the impulse of lofty idealism that great forward strides are possible. A nation or a race can rise no higher than its philosophy. The Germans have evolved only philosophies of negation and of finite limitations, in which the genius of human sympathy and development finds no nourishment. Mr. H. G. Wells said recently, "Germany has never been superior to any one of her antagonists; she has merely been more heavily organized for the exploitation of technical science, and with a vastly greater number of workers therein." The hope of civilization lies in the group of people now banded together to save mankind from the barbarian that has menaced human progress since the first horde levied tribute upon Rome 2300 years ago.

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The Editor:

Sir—Mining communities and camps in different parts of the world have different characteristics, and what has often struck me in connection with our Western camps is the apparent indifference to religion, if one judges from outward signs—I make this proviso, because I have often noticed that deep down in many a rugged and time-worn miner's heart there is a true respect for religion.

Some years ago, a few of us started Sunday-evening meetings in a Western mining camp, and these meetings were remarkably well-attended. The singing of the old hymns was the strong feature of the meetings, the audience being called upon to choose their favorite hymns. Many a time I have seen an old prospector tremblingly ask for a certain number, and have watched the tears course silently down his cheeks as the old memories were brought back by hearing the familiar tune—what a strange thing is memory, and how it links the present with the past. I am afraid the saying one often hears out here, that when a man from the East crosses the Rockies he leaves his religion behind him, is often only too true; so many come, lured on by the vision of getting wealth, and, like the fable of the dog and the reflection of the bone in the clear water, drop the substance and grasp at the shadow.

The general conditions at our Western mining camps do not encourage religious activities. As a rule a large proportion of the workers do not have their homes at the mine, and are there with the one object of making a stake, and in their blind pursuit of the fleeting dollar, God's laws, which are the only foundation of true prosperity, are often brushed aside. This is not only the case here, but in other countries, as is illustrated by the following incident: A man who had started mining as a trucker had risen to the position of underground superintendent at a large mine in Australia, and, of course, was very keen to hold his job. On a visit to the mine, I was discussing with him some features in connection with contract work, and he made a suggestion that to me seemed very unfair to the men, and my calling his attention to it elicited the following remark, "I am working for the Company and looking after their interests, and when I engaged with them it meant giving all my time and ability to their service." I said this seemed all right, but that a man had a soul, whereupon he remarked "Well, I am willing to throw that in." I have since watched this man, and although financially successful, I do not think that, if the correct meaning of 'success'—a prosperous termination of something attempted—be applied to his life, it would fit. Christ's injunction "Render unto Caesar the things that are Caesar's, and unto God the things that are God's" is one we should all ponder over, as a man will serve his employer better if he gives heed to it.

Not to have his home at a mine is a handicap to a miner, and has a tendency to put religion in the background, but a far more serious factor in stifling religion in our Western mining camps is the almost universal disregard of the Sabbath as a day of rest and spiritual refreshment. It seems so strange to me that Sunday work, which has been abandoned in most other countries under Anglo-Saxon rule, is still clung to here. God knew what he was about when he instituted the Sabbath, and when I see men going on and coming off shift on Sunday, it always reminds me of children who think they know more than their fathers. In discussing this problem with miners, their usual argument is that they prefer work to lying around on Sunday, especially as their board has to be paid just the same that day; and the superintendent's attitude is that as the men prefer to work on Sunday, he sees no reason why they should not. This, of course, is weak, as in most other things he does not allow them their own choice. The 'Safety First' is now a familiar sign at most mines, showing some regard for a man's limbs, but he is left to look after his own soul, and not given much of an opportunity to do this.

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change was noticeable, and they began to look forward to the day off and to plan ahead how to spend it. I found that it was, after all, a matter of habit—they had been so long accustomed to work on Sunday that they actually did not know how to spend it in any other way. If a condition like this is not a reproach to our system, I would like to know what is.

I was recently at a mine back in the hills, and we heard over the telephone that a church service was to be held the next Sunday at a small town about four miles distant. Two of us decided to attend, and drove down in a two-ton auto-truck, certainly a formidable vehicle to go to church in. We found about 18 ladies present and one man, and afterward found that the man had driven in with the preacher. We were a bit late, as our chariot was not as swift as we expected, and I noticed how the poor preacher perked right up when he noticed two real men in his audience.

If we go back 100 years or so, we find religion was indeed a man's job, and this was especially the case in this country. Now men have so many important things to do on Sunday, that everything in connection with church and religion falls to the woman's share. I think men should at least find time to take some interest in sunday-school work, as this is now about the only means our children have of becoming acquainted with those vital things our forefathers sacrificed so much for. If a father can find no time on Sunday for religious activity he can hardly expect his boys to do so.

It always seems to me that mining, especially prospecting, should develop faith, and that this should ultimately reach out and find God, but it so often has just the opposite result, because the gold and silver, instead of being made a means to an end, are made the end themselves. Many years ago I was in charge of a small assay-office far back in the mountains, and one rainy afternoon a prospector knocked at the door, and upon my admitting him, asked if I could run a sample. I told him I would do this and that he could wait while I put it through, and asked him to be seated. I noticed that he seemed nervous, and after a while he explained why he was so anxious about the sample. He said he had been five years driving a tunnel to cut his vein, working alone all the time, and that he had just cut it, five feet wide, and if the sample ran well he was a 'made' man. I put the sample through the bucking process, then into the crucible, and the resulting lead button into the cupel, explaining each step to the prospector as I went along, little dreaming what an ordeal I was to put him to. As I put the lead button into the cupel I told him that the lead would be absorbed, and that if the ore contained silver or gold it would remain as a small bead on the cupel. He stood in front of the red-hot muffle, peering in as though looking for a lost soul, and some time before the 'blick' came, my experienced eye told me the sample was very low-grade. I was busy at some other work when I suddenly heard an anguished cry, "Why, it is all gone," and the prospector sank to a seat, trembling and sobbing as though his heart would break. Of course, one will say he was a weak man, but still he had grit enough to work five years alone, impelled by his vision of fortune—how true are Christ's words "Where your treasure is, there will your heart be also."

"Surely there is a vein for the silver, and a place for gold where they find it," and if those engaged in digging the precious metals and bringing them to the light, could only realize that the losing of a sense of need and appreciation of God is not progress, notwithstanding what is said by some of our popular writers who are "ever learning and never able to come to the knowledge of the truth," but the most unfortunate condition a human being can come to, there would be time and opportunity provided for the development and nourishment of the spiritual side, and if one has even the smallest faith in God's promises, he would know that the industry, instead of suffering, would be more prosperous.

This terrible world's conflict should be a lesson to all of us. It is of no use merely saying "Germany started it," as the trouble is we are all in it, and each country is losing the prime of its young manhood. Is it possible that we have all been drifting away, and have broken down the hedge that God made about us for our protection, and that now He has allowed the sword to come into the land to open our eyes and to bring us back from the paths we were blindly following, and which lead to nowhere?

Our President, in his official proclamations, recognizes and lays stress upon the religious side of civic life, and I think we who are engaged in the so-called material occupation of digging for the precious metals, will do well to give heed to what he says.

F. C. Brown.

Quartzburg, Idaho, August 9.

[The prospector has been misled by the incorrect quotation of Job's words so often that it seems necessary to state that the Bible says "fine"—or refine—not "find". Job must have been in a cynical mood when he said that; he might as well have stated that there is gold in the mint. Mr. Brown, however, is quoting the prospector, not the Bible. We feel sure that what he says will appeal to many of his old friends in the hills and to those that go down the mine in skips.—Editor.]

Henry R. Merton & Co. In answer to a question in the House of Commons it was stated: The Metallgesellschaft formerly held a large number of shares in Henry R. Merton & Co., Ltd., but does not now hold any shares; the Australian branch of the company has been closed. The present directors of the company are S. Baer, H. Gardner, W. Gardner, O. Lang, E. R. Merton, and M. Wilson. German subjects have an indirect financial interest in the company through the holding of 11,857 shares by a Swiss company which is believed to be under German control. The company is not now doing any work for the Government. Under the provisions of the Non-Ferrous Metal Industry Act the company will not be able to trade in non-ferrous metals without a license, and in this case the Board of Trade has refused to grant a license.

The Bradford Process at Broken Hill

By EDWIN T. HENDERSON

Since September 2, 1916, the Bradford process has been in operation on the Broken Hill Proprietary mine, Broken Hill, treating approximately 3000 tons of slime weekly.

The greater part of this slime is obtained from old slime-dams, the remainder being made up with current slime from the ore-dressing mills.

The dump material is loaded into trucks holding 1750 lb. each, and hauled to the plant by horses. Each train consists of four trucks, one horse being able to haul this quantity comfortably. Two horses are kept going constantly.

As the trains arrive at the plant they are tipped into a hopper placed below the ground-level. As each truck is tipped a boy throws a shovelful of nitre-cake weighing about 8 lb. into the hopper as an emulsifying agent, and this passes on with the slime. Recent tests indicate that the mineral salts in solution in the plant-water are themselves sufficient for emulsification. No oil is used for flotation purposes in this plant.

This hopper has a six-inch opening running the full length of the bottom, and delivers the slime as tipped onto a 24-in. belt-conveyor traveling at 260 ft. per minute. This conveyor carries and elevates the slime to a mixer 8 ft. diam. and 6 ft. deep, having an arm (6 ft. diam.) revolving at 42 revolutions per minute in the bottom. Solution is added here, and the slime is mixed to a flowing pulp.

The discharge from this mixer is taken from one side, 18 in. from the bottom. The pulp flows in a box-launder to a tube-mill loaded with flints and making 7 r.p.m. The purpose is to break up any small lumps of slime that have escaped the first mixer.

A screen, 32 in. diam. by 2½ ft. long, made of punched trommel-plate having ⅛-in. holes, is bolted to the discharge end of the tube-mill. This screen is fitted inside with an Archimedean screw, which revolves with the screen and works any wood-pulp or rubbish that will not pass the holes to the discharge, where it falls down a chute and is removed from time to time.

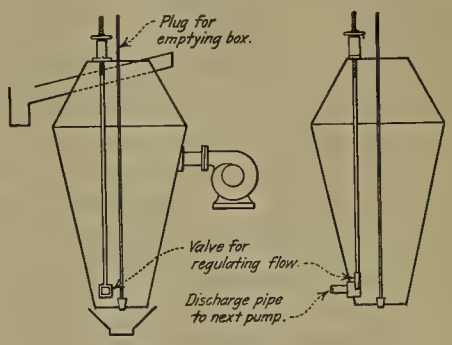
The pulp that passes through the screen flows in a launder to a storage-vat, 30 ft. diam. by 5 ft. deep. This vat is fitted with revolving arms, 26 ft. diam., made of channel-iron, with scrapers attached similar to a Dorr thickener, only set to throw toward the periphery. These arms make 3 r.p.m. and keep the slime in suspension.

The current slime from the mill, after being dewatered in a Dorr thickener, is discharged to this storage-vat. The pulp in this vat contains 50% solid.

The vat is discharged by means of a 6-in. pipe bolted to the side close to the bottom. A gate-valve placed close to the vat regulates the flow. This pipe takes the pulp to an elevator that delivers to a small mixer at the head of the plant. This mixer is 5 by 5 by 5 ft. and has an arm 4 ft. 6 in. diam. revolving in the bottom at 29 r.p.m. Clear solution from storage-vats is added here in sufficient quantity to break the pulp down to 25% solid by weight.

Sufficient acid is added to acidify the pulp, and sodium hyposulphite to the extent of 1.5 to 2 lb. per ton. The latter is made up to a 30% solution on the ground-level and pumped to a 400-gal. tank placed alongside this mixer. The flow is regulated by means of a tap, which is adjusted to deliver one pint in 40 seconds. The flow through the plant ranges from 20 to 25 tons of solids per hour.

From this mixer the pulp passes through two short



SKETCH OF SEPARATION-BOX

lengths of 6-in. pipe to a similar mixer placed on the same level alongside. The object of the mixer is to give the necessary time for the SO_2 liberated from the hyposulphite to wet the zinc sulphide.

The acidity, density, and temperature of the pulp are tested in this mixer repeatedly. The best work is obtained when the acidity is between 0.025 and 0.03, the temperature between 85 and 90° F., and the density between 23 and 26% solid by weight.

The density is obtained by filling a bottle made of tin and calibrated to hold 1000 cc. H_2O at 90° F. The density of the circuit-liquor runs at 1.05 sp. gr., and a table is fixed alongside the balance showing the percentage of solid corresponding to any weight of charge.

The discharge from this second mixer is through a 4-in. cast-iron pipe bolted to the side of the mixer, and about 6 in. above the bottom. A slide-valve is placed over the mouth of this pipe in the mixer, and this is adjusted by means of a screw, to give any desired flow. The pipe delivers to the suction of the first agitator of the lead section.

These agitators are of a special design. They are in

the form of a centrifugal pump and act in the same way, but give a much better agitation. The runner consists of a circular disc on the sides of which two rings of pegs project a distance of 1½ in. from the face; the runner is 17¾ in. diam. Lining plates are placed inside the casing of the agitator. The side plates have two rings of pegs similar to those on the runner. One of these rings fits between the two rings on the runner, and the other between the smaller ring and the centre. The suction-pipe is coupled to both sides of the casing, so that the pull on either side of the runner is balanced. A half-inch pipe is tapped into the suction on both sides of the casing, and these are joined up on top to an inch pipe, which is in turn coupled to a 3-in. main running along the top of the plant. This main is connected to sulphur-burners, to be described later. Through these pipes the agitators draw their supply of air and sulphur di-oxide.

The runner in the agitator revolves at 1080 r.p.m. The gas and pulp entering at the centre have to run the gauntlet through the revolving and stationary pegs on the runner and side plates, and the air is thoroughly broken up. Clear solution at a suitable pressure is delivered through half-inch pipes near each gland to prevent the grit coming into contact with the gland, and thus reduce the wear on spindles.

The agitator delivers through a 4-in. pipe into a separation-box (see sketch attached) where the lead sulphide floats and forms a froth 3 ft. deep, overflowing on top so as to pass to the main lead-concentrate launder.

From one side near the bottom of each separation-box a 4-in. cast-iron pipe leads to the suction of the next agitator of the series. A slide-valve fitted inside each box, and operated by an iron rod passing to the top of the box, controls the flow from one box to the next. The control of the flow of pulp through the agitator also regulates the amount of gas drawn in and incidentally the power consumed. The smaller the flow the greater the supply of gas and the smaller the power required, and the reverse.

There are nine of these agitators in the series, each drawing dilute SO_2 from the burners and delivering the agitated pulp to a separation-box where the lead floats off. Most of the lead is removed in the first four boxes, and after this the lead on each succeeding box becomes shallower, until at the ninth practically nothing remains, and it is allowed to overflow slightly. This overflow is returned to the head of the system.

It is found that the lead is cleaner if a small amount of acid is added to boxes No. 6 and 7; the solution has become neutral by this time, and the addition should be just sufficient to make it slightly acid. Steam is also added to the last four agitators to raise the temperature in No. 9 box to 90° F.

The agitators are driven in pairs by means of a belt from the main shaft, which in turn is belt-driven from a 250-hp. engine.

The discharge from No. 9 separation-box is through a 4-in. cast-iron pipe, fitted with a valve to control the flow. This pipe delivers the pulp to two 30 ft. Dorr thickeners, 10 ft. deep, which settle the zinc middling and give clear solution at a temperature of about 90° F. flowing to the solution-tanks at the head of the lead section.

The lead concentrate overflowing from these separation-boxes passes in a common launder to a storage-vat placed on the ground-level. This vat is 20 ft. diam. by 5 ft. deep, and is fitted with stirring-arms making 14 r.p.m., so as to keep the solid in suspension. The pulp in this vat contains 40% solid by weight, subsequently thickened in a storage-vat, 14 ft. diam. by 18 ft. deep, to 70% solid, whence it is pumped by means of a three-throw plunger-pump to filter-presses of the Dehne type; each press has 50 leaves, and the cakes are 3 in. thick.

The press holds 9 tons of lead concentrate. Two of them are required to press and dry the concentrate produced. The drying is done by blowing compressed air at 80 lb. pressure through the cakes for 30 minutes. The moisture is in this way lowered to 10%. The cakes, when dropped from the press, fall onto bars placed over a conveyor; this delivers its load to a second conveyor, which carries it to the bins.

The arms on the Dorr thickeners treating zinc middling make one revolution in 1½ minutes. The discharge from these, containing 60% solid by weight, is delivered to an elevator that lifts to an overhead launder running to two vats, 20 ft. diam. and 7 ft. deep, which act as storage-vats for the zinc section. These vats are fitted with revolving arms making 14 r.p.m., to keep the solid in suspension. Steam is blown into the pulp in these vats, and the temperature is thus raised to 125° F.

An elevator is placed between these two vats and they discharge to it, through 4-in. cast-iron pipes fitted with a valve to regulate the flow. These pipes are bolted to the sides of the vats and are about 2 ft. long. This elevator raises the pulp to a launder delivering to a small mixer 5 by 5 by 5 ft. at the head of the zinc section. This mixer has an arm 4 ft. 6 in. long revolving at the rate of 29 r.p.m. Here solution from the zinc section solution-tanks is added to break down the pulp to about 20% solid, and acid equal to 30 lb. per ton, to acidify the pulp to approximately 0.3%. The temperature of the pulp is about 125° F.

The discharge is through a 4-in. cast-iron pipe, fitted with a slide-valve in the mixer similar to the lead section. This discharge-pipe connects to the suction of the first agitator, which has a half-inch pipe tapped into the suction, and carried to the top of the separation-box. A plug-valve is attached to the end; the agitator draws air through this pipe, and is controlled by setting the valve. In order to make this adjustment easy, the plug in this valve is not tapered and the hole consists of a slot $\frac{1}{16}$-in. wide and half an inch long.

The agitators of this section consist of ordinary centrifugal pumps, the runners having three arms set at 60° and revolving at 960 revolutions per minute.

The separation-boxes are similar to those of the lead section, and the valves for controlling the flow are the same. There are six of these boxes. The agitators are driven in pairs by means of a belt off the main shaft; this shaft is driven by a 100-hp. motor.

The zinc floats rapidly. The head in the separation-boxes ranges from 36 in. deep in the first four to 18 in. in the fifth, and the sixth is kept overflowing slightly. This overflow is sent to the zinc-middling Dorr thickeners for re-treatment.

The acidity of the pulp as it discharges from No. 6 pan is kept at about 0.08%, as the tailing is cleaner with this acidity than with a lower one. The discharge from No. 6 pan is through a 5-in. cast-iron pipe to two 25-ft. Dorr thickeners 10 ft. deep; the arms on these make one revolution in two minutes. The overflow from these thickeners passes in a launder to the zinc-section solution-tanks, where it is kept up to temperature by having steam blown into it. The tailing-discharge, from the bottom, delivers to an elevator that raises it to a small box to which two lines of 4-in. piping are fixed. These pipes carry the pulp to the tailing-dams. Only one is used at a time, the other being kept ready in case of a choke. High-pressure water is connected to these pipes so that in case of their becoming blocked they can be readily cleared again.

The zinc concentrate overflowing from these separation-boxes pass to a common launder delivering to a small elevator. This raises it to a height sufficient for it to flow down a launder to the zinc re-treatment plant, where it is delivered into a small mixer at the head, similar to those previously described. Here it is diluted down to an 8% pulp and re-floated in three separation-boxes.

Everything in this plant is similar to that on the first zinc section, except that the agitators are direct-coupled to motors. The first two have a 30-hp. motor placed between them, and the third is coupled to a 15-hp. motor. Very little acid is required in this section, there being hardly any acid-consuming material present. The acidity of the pulp is kept at 0.1% approximately.

The discharge from the third box passes to a 25-ft. Dorr thickener 10 ft. deep; the arms on this make one revolution in two minutes. The overflow from this passes to a storage-tank from which it is pumped to the small mixer at the head of the separation-boxes. Steam is blown into the solution-tank in quantity sufficient to keep the temperature at 125° F. The discharge from the bottom of the thickener passes to the elevator taking the drainage from the first zinc-float section, and this delivers it to the zinc-middling thickeners for re-treatment.

The final zinc concentrate from the three re-treatment boxes flows in a launder to a vat on the ground-level. This vat, 20 ft. diam. and 5 ft. deep, is fitted with arms revolving at 14 r.p.m., to keep the solids in suspension. When this vat becomes full it is pumped out to the zinc-storage dams.

The floor under each section of the plant is concreted and faced with cement, and is in the form of a large spoon-drain. That under the lead section falls to an elevator, which takes any leakage with any material discharged from the bottom plugs of the separation-boxes, and returns them to the first mixer, from which it passes with fresh dump-slime through the tube-mill to the feed-storage vat.

The floors under the first zinc-float section and the re-treatment section both fall to a common elevator. Any leakage or discharge from the bottom plugs of these boxes passes to this elevator, together with the discharge from the re-treatment Dorr thickener, and are returned to the two 30-ft. diam. zinc-middlings Dorr thickeners. By this means any slime accumulating on the floor can be readily cleaned up by washing with a jet of water.

The sulphur-burners are of simple construction. They consist of two cast-iron pipes, 20 in. diam. and 10 ft. long, laid on the ground. The two ends are closed by means of pieces of boiler-plate secured by bolts. Through one end of each a hole 1¼ in. diam. is bored, slightly above the centre of the pipe; this hole is to admit air. The other end of each burner is coupled to a 3-in. cast-iron pipe into which the burner-gas delivers. This connection is made as near the top of the end plate as possible.

A 4-in. cast-iron pipe is coupled on to the top of each burner near the end that the air enters. This pipe supplies the means of charging the sulphur, and is kept closed by means of a piece of plate and insertion-joint held in place by two bolts. The 3-in. pipe passes to a receiver made of cast-iron. This is 3 ft. diam. and 8 ft. high; it condenses most of the sulphur that may be volatilized accidentally.

From the top of this receiver a 3-in. wrought-iron pipe is carried up to the top of the plant, and then along the entire length of the lead section. Into this pipe the 1-in. pipe leading to each agitator is connected. The smaller pipes, one inch and half-inch, are fitted together with unions so that they can be readily taken apart and cleaned in case they become blocked. The sulphur burnt amounts to 1 to 1.3 lb. per ton of slime treated.

The supply of acid for the plant is run from the acid plant to the main tank through a 1-in. lead pipe; this tank is placed at the highest point of the plant, and the acid can be drawn from it to the three smaller tanks placed close alongside the small mixers at the head of each section. All these tanks are fitted with overflows leading to a large tank on the ground-level. By opening a valve in the bottom of any of the elevated tanks the acid can be run to this tank; the arrangement is convenient, and repairs can be readily effected at any time.

The principal points that require careful watching are as follows:

(1) That the temperature of the pulp at the head of the lead section does not rise above 90° F. If it does, the line has a tendency to float and seems to crowd out the lead.

(2) That the pulp on the lead section does not rise above 27% solid by weight. Higher pulps result in low-grade lead concentrate and incomplete recovery; this, of course, means low-grade zinc.

(3) That too much hyposulphite is not used. If more than 3 lb. per ton is added, it causes the zinc to be slow in floating in the zinc section and makes a high tailing.

(4) That the acidity of the pulp on the lead section

does not rise much above 0.03%, as this has the same effect as too much temperature. If the solution becomes neutral, the lead concentrate falls in grade owing to gangue passing over with it. In practice no trouble is experienced in maintaining any of these conditions.

(5) That the SO_2 pipes do not become choked. The SO_2 keeps the lead clean, and a choked pipe generally shows itself in the color of the lead flowing from the separation-box. Choked pipes also increase the power required to drive the agitators. The chief cause of this trouble is volatilized sulphur, due to excessive heat in the burners. This can be checked by having a few holes in the 3-in. SO_2 main, which, if the temperature of the burner starts to rise unduly, can be opened; air will then be drawn in through these and less through the burner, thereby checking the combustion.

The assay of the material being treated is as follows:

Zinc	16.5%
Lead	12.8%
Silver	15.5 oz.
Oxidized lead	4.7%

Sizing-tests on the feed give:

Plus 150	8.0%
Plus 200	5.5%
Minus 200	86.5%

The lead concentrate contains:

Zinc	8.0%
Lead	63.0%
Silver	84.0 oz.

The zinc concentrate contains:

Zinc	50.0%
Lead	4.0%
Silver	13.0 oz.

The tailing contains:

Zinc	2.0%
Lead (total)	8.0%
Silver	4.2 oz.
Oxidized lead	7.0%

The agitators in this plant run for five weeks, when they require new lining-plates and new runners. Between 14,000 and 15,000 tons of slime passes through the agitators in this time. From three to four agitators are changed weekly. The elevators have to be overhauled every week, and the slide-valves over the discharge-pipes of the separation-pans have to be seen to weekly. The slides are made so that they can be turned upside-down, and when one end is worn it is turned top-to-bottom and then runs for another period. These constitute the main repairs.

Small-scale tests indicate that the oxidized lead now passing out with the tailing can be readily re-sulphidized and recovered together with the silver, reducing the assay of the residue to about 1% lead and 1 oz. silver per ton. A plant is now being designed to do this.

Gold For Industrial Use

Following the order on September 6 permitting a resumption of restricted deliveries of gold from the Mints for manufacturers use, a further notice was issued on September 9, and we reproduce the announcement as made by Verne M. Bovie, superintendent of the U. S. Assay Office at New York:

"The trade is hereby notified that I have this morning received the following order from the Director of the Mint:

" 'Pursuant to an Act entitled 'An Act to authorize the receipt of U. S. gold coin in exchange for gold bars', approved May 26, 1882, as amended by an Act approved March 3, 1891, and by an Act approved March 3, 1901, it is hereby ordered that from and after this date, and until further notice, the several Superintendents of coinage Mints and of the U. S. Assay Office at New York shall not pay nor deliver gold bars in exchange for U. S. gold coin or gold certificates pursuant to said Act, unless the applicant therefor shall obtain and exhibit to the Superintendents concerned the following documents of authority:

" '1. In case of bars intended for industrial use within the United States (including the Canal Zone and all Territories and waters, continental or insular, subject to the jurisdiction of the United States), an industry priority certificate issued by the War Industries Board, or a similar authority from said Board, for the use intended to be made of such bars.

" '2. In case of bars intended for exportation, license for exportation issued by the Federal Reserve Board.

" '3. In any other case a special order of the Secretary of the Treasury approving the transaction.

" 'When any gold bars are delivered to any applicant pursuant to the foregoing, the date of delivery, the value of the bars, and such other data as may be necessary to indentify the transaction shall be entered, or endorsed, by the Superintendents concerned, upon the document of authority in such manner as may essentially prevent the use of such document in the future as authority for a repetition of the delivery of gold bars of the value then delivered. The Director of the Mint is authorized to issue such further instructions as may be necessary to carry into effect the foregoing order.'

"In accordance with said order, no further payments of gold bars in exchange for gold coin or gold certificates will be made except in the manner indicated in said order."

The Director of the Mint has virtually suspended deliveries of gold bars for industrial purposes until further regulations controlling industrial uses of gold shall be framed. The gold drawn from the Treasury for alleged application in the arts during the fiscal year ended June 30 this year, amounted to $55,000,000, which was $12,000,000 in excess of withdrawals for like purposes in the preceding year. For comparison it is interesting to note that the annual report of the Director of the Mint for 1917 records that new gold was issued to manufacturers in 1916 to the value of $41,120,149, in 1915, $29,599,507, in 1914, $37,412,758, in 1913, $37,501,831, in 1912, $35,870,552, and in 1911, $33,103,054. These figures do not include the old gold, in the form of jewelry, plate, and scrap, in the returns from private refineries. This has been running at the rate of from seven to nine millions of dollars' worth per annum. The sudden increase in the demand for new gold was regarded as not being wholly warranted by legitimate need in the arts.

THE ILMEN MOUNTAINS, IN THE URAL REGION

The Physical Geography of the Ural Mountains

By H. W. TURNER

The present and prospective operations of the Allies, seeking to aid the Russian people to establish a stable government, lend especial interest at this time to the geography of Russia.

The Russian dominions are peculiarly unfortunate in their relation to foreign commerce in that the numerous gulfs and bays of the coast are all ice-bound in winter except at Kola on the Arctic and in the Black Sea. However, numerous large rivers aid internal communication. Of these the Don and the Dniester drain into the Black Sea and thus afford a means of cheap transportation from Little Russia to warm-water ports connected with the ocean; but the most important river of old Russia, the Volga, ends its long career in a dead sea, the Caspian. Petrograd is situated at the eastern tip of the gulf of Finland, which is frozen in winter. So is the entrance to Vladivostok, on the Pacific. The Dvina, Ob, Yenesei, and Lena, all large rivers that drain north into the Arctic, and the Amur, draining easterly into the Pacific, at Nikolaievsk, are ice-bound in winter. It is small wonder then that the Russian government for centuries has looked with longing eyes at Constantinople, and later at Port Arthur.

On the sketch map (Fig. 1) is shown the general position of the Ural range, which forms the dividing line between old Russia on the west and Siberia on the east. The Allies are already established at two points, namely,

(1) Murmansk on the Arctic Ocean, where there is an open port in winter, which has recently been connected with Petrograd by a railroad, and

(2) Archangel, the seat of the new Tschaikovsky government and the present home of the American embassy. Archangel is on the White Sea and is not an open port in winter but is connected at Vologda with the main Perm-Petrograd railway.

The Ural mountains are doubtless regarded by many as a high and definite range separating Russia from Siberia. As a matter of fact they consist rather of a series of nearly parallel ridges rarely exceeding 5000 ft. above sea-level. These ridges form a broken chain extending geologically from the island of Nova Zembla in the Arctic to near the Aral sea, a distance of over 1800 miles. At the south end the range may be said to fork, the direct southern continuation to the Aral sea being known as the Mugadzhar mountains, whereas another branch extends westward along the north side of the Ural river, west of Orenburg.

While now a broken chain, the geological evidence indicates that at one time the Ural mountains were much higher and were formed of a series of nearly continuous ridges. The rocks comprising the chain are chiefly of the Devonian and Permo-Carboniferous ages. Along the central axis the Devonian rocks have been sheared and compressed into schist, with which are associated large

areas of intrusive igenous rocks, serpentine (peridotite), gabbro, diorite, and granitic rocks. There are also areas of greenstone representing former surficial volcanic extrusions now metamorphosed. The serpentine is known to be the source of much of the platinum for which the range is famous. In the Devonian schist and associated metamorphic and intrusive rocks are likewise found many important copper and iron deposits, while the Permo-Carboniferous series on the flanks of the range likewise contain numerous small deposits of hematite ores that have been mined and smelted since the time of Peter the Great. In traversing the central Ural region by wagon-roads, the traveler is surprised at the great number of these little smelting-works, each with a reservoir of water, near which is always a town or village, the home of the iron-workers and miners. Except in the larger towns, the prominent structure in these places is usually the Greek church.

The iron mines themselves are often mere surface cuts, although sometimes of large dimensions, and if future military operations reach to this region these old cuts may easily serve as ready-made trenches. Some of them, as in the north-western portion of the Kasli district of the Kyshtim estate, extend in broken lines for miles.

The copper deposits are less developed, but some of them have been mined and smelted for over a hundred years. One of the more important copper properties is that at Kyshtim, belonging to a British company, but now taken over by the Bolshevists and operated by them. This was a comparatively easy matter, since most of the foreign technical staff had been replaced by Russians educated at Freiberg, Germany, before the control of Russia passed to the Bolshevists. Some of the smaller copper deposits on the estate and many of the iron deposits were worked by the Russians in the previous century, but the treatment of the pyritic copper ores awaited the application of modern smelting methods introduced by the present British owners. Since the taking over of the property by British capital, more than 44,000 tons of copper metal has been produced, most of which was refined on the estate in the first copper-refinery established in the Ural.

The present writer is familiar only with the central Ural region (Fig. 1), and the following descriptions apply more particularly to this area. The main Moscow-Vladivostok or Trans-Siberian railway crosses the Ural range at Miass and Zlatoust; from Cheliabinsk, a little to the east, a branch line runs north along the axis of the Ural through Kyshtim to Ekaterinburg. This is the most considerable town in the Ural region and was reported to have 70,000 inhabitants before the War. It was near this place that the former Czar is said to have been executed. From Ekaterinburg one branch of the railway runs westward through Perm, Viatka, and Vologda to Petrograd; another branch goes south-easterly through Tumen to Omsk, where it joins the Trans-Siberian main line.

The prosperity of the Ural region is based largely on the mining and gem industries. The great central market for gems is Ekaterinburg, the gems being mostly of the

FIG. 1. MAP OF NORTHERN RUSSIA, SHOWING THE LOCALITIES PROMINENT IN THE WAR

FIG. 2. NEAR SOYMONOVSK, ON THE KYSHTIM ESTATE

FIG. 3. BASHKIRS IN CAMP

semi-precious kind, such as aquamarine, topaz, zircon, corundum (sometimes fine enough for sapphires), phenacite, alexandrite, and amethyst, all of which come from from the surrounding mountains. Ekaterinburg is also the home of the Société Ouralienne des Amis des Sciences Naturelles. This society has creditable collections and publishes the results of scientific investigations made by its members. Near its museum is the Imperial establishment for polishing the many ornamental stones of the Ural, used for interior decoration of chapels and art buildings.

The Ilmen mountains, one of the separate ridges of the Ural range near Miass, is particularly noted for large crystals of aquamarine, topaz, zircon, amethyst, and amazon-stones, the last a green variety of orthoclase feldspar. These crystals occur mostly in pegmatitic veins in gneissic rocks.

The general topography of the hilly portions of the Ural is more or less similar throughout (as illustrated by Fig. 2), which is a view in the vicinity of Soymonovsk in the southern part of the Kyshtim estate. The hills in the distance have an elevation of about 2500 ft. Between the ridges there are meadows, often wet and traveled with difficulty by wagons during the summer season, except where roads have been built.

Along the axis of the Urals and more particularly on the flat eastern slope, which merges into the great Siberian plains, there are numerous lakes, some on rather flat land, as Lake Uvildi on the Kyshtim estate, and others surrounded by hills. Most of these are well supplied with edible fish.

Taken as a whole the Urals are well wooded, in the central portion chiefly with small pines, trees over two feet in diameter at the base being unusual. Nevertheless these trees are suitable for the saw-mill and are almost universally used by the peasants in constructing their cabins. They are also used for larger structures in many places.

The climate is not dissimilar from that of northern Alberta, the winters lasting from October to May, being quite cold, with a minimum temperature of about 40° F. below zero and uncomfortably warm sultry spells in the summer with temperature in the 'eighties. The precipitation is moderate, the snow being seldom over three feet deep in the winter, while showers are frequent in summer.

The chief inhabitants of the Ural are typical Russians, but on the flanks and neighboring plains are many Bashkirs (Fig. 3). These people belong to an ancient Tartar-Finnish race and number several hundred thousand. Originally independent, they submitted to Russian rule in 1556. They lead a nomadic life, are largely employed in raising stock, and are Mohammedan in religion. Like the Kirghiz of Siberia, they are not subject to military duty, except as volunteers.

MANGANESE imports into the United States for the first half of 1918 totaled 244,823 tons, a decrease of 61,967 tons when compared with 1917. Brazil supplies most of this. Final figures of shipments from that country during the last three years are as follows: 1917, 532,855; 1916, 503,130; and 1915, 288,671 metric tons. In the last two years all went to the United States. The Brazilian output in 1913 was only 120,000 tons.

The Fluorspar Industry

Statistics of the fluorspar industry in 1917, prepared under the direction of Ernest F. Burchard, of the U. S. Geological Survey, show a great increase in the domestic output of this valuable fluxing mineral, when compared with former years. Shipments of spar from the mines in 1917 were 218,828 short tons, valued at $2,287,722, an average price of $10.45 per ton, compared with 155,735 tons, valued at $922,654, or $5.92 per ton, in 1916. This represents an increase in tonnage of 40.5% and in value of nearly 148%. The quantity of crude fluorspar mined in the United States in 1917 reached a total of 280,825 tons, compared with 175,165 tons in 1916, an increase of more than 60%. Stocks of marketable spar on hand at the end of 1917 amounted to 21,655 tons, compared with 3666 tons at the end of 1916, but a considerable part of this stock was under contract, awaiting cars, boats, or weather favorable for shipment.

The demand for fluorspar may be said to be governed mainly by the open-hearth steel industry, so that supplies that are within reach of steel-making centres are certain to be drawn-on heavily during war times. Mines in all producing States except Arizona reported an exceptionally heavy demand during 1917, and the high prices stimulated prospecting and led to the opening of many hitherto unworked deposits in Illinois, Kentucky, and Colorado.

The apparently moderate average price received for fluorspar at the mines during 1917 was largely due to the making of sales on yearly contracts, but spar not so purchased was subject to much higher prices. In January and February 1917 gravel-spar for prompt shipment brought $21.50 per ton at the mines, and a year later $38 to $40 was reported as the ruling price. The latter figures were unduly inflated because cold weather and railroad congestion retarded both mining and transportation. Prices decreased from these high levels later in 1918, so that in June and July, $28 to $30 at the mines was quoted for gravel spar carrying 85% calcium fluoride (CaF_2).

Gravel-spar constitutes the bulk of the shipment. In 1917 the output of this product amounted to 183,144 tons, valued at an average of $9.61 per ton, compared with 133,651 tons, valued at $5.34 per ton, in 1916. Lump-spar and ground-spar also increased.

Imports of fluorspar in 1917 increased slightly in quantity but greatly in value, 13,616 tons, valued at $8.42 per ton, having been imported in 1917, compared with 12,323 tons, valued at $4.38 per ton, in 1916.

Estimates of production for 1918 total 218,000 tons. If sufficient labor, machinery, and other supplies were available the output would be larger.

Simple Method for Determining Sulphur Di-Oxide

By G. W. JONES, J. H. CAPPS, and S. H. KATZ

INTRODUCTION. *The engineers of the U. S. Bureau of Mines have had need for a method for determining the amount of sulphur di-oxide in the air of sulphide-mineral mines, especially in the event of fires. The requirements were an apparatus of strong, cheap, and readily replaceable parts, easily portable, and workable by the average engineer. With these ideas in mind the method herein described was developed. No especial originality is claimed for it. Similar processes have been used by others for a long time. It is believed, however, that this adaptation can be used to advantage in the particular field for which is was planned. During the experiments a record was made of observations of the effect on the senses produced by various concentrations of sulphur di-oxide gas.

The work described herein forms part of an uncompleted study of sulphur di-oxide to be published by the Bureau of Mines.

APPARATUS. The main apparatus, shown in Fig. 1, consisted of two 2½-litre aspirating-bottles with tubulars joined by a rubber tube, clamped with a pinch-cock. One bottle was completely filled with acidified water to be described later. This bottle was closed with a two-holed rubber stopper. Through one hole was run a 100-cc. separatory funnel with a stem of 1-mm. bore. The top of the funnel was closed by a one-holed rubber-stopper glass capillary-tube, rubber tube, and pinch-cock. Through the other hole of the rubber stopper extended one arm of a three-way cock. This arm was bent into U form, for the purpose of directing the incoming stream of gas against the rubber stopper so as to break it up and prevent contact of gas and water as much as possible. The other bottle was closed with a one-hole rubber stopper holding a guard-tube. This was filled with soda-lime with one inch of cotton wool on top for a filter. The guard-tube was closed by a one-hole rubber-stopper glass tube and rubber tube with pinch-cock.

This apparatus, together with its accessories, was carried, in the receptacle shown in Fig. 2, designed for portability and accessibility. The accessories consisted of five bottles of reagents, to be described hereafter, a 50-cc. graduated cylinder with divisions 0.2 cc. apart, two long glass tubes, and a rubber-bulb hand-pump with rubber tubing attached. The tubes and pump were for use in securing samples. An extra guard-tube containing soda-lime was provided for use in some special instances. The outfit and case complete measured 10½ by 20½ by 23 in. and weighed 35 pounds.

SOLUTIONS. The liquid used to aspirate the sample into the bottle is the purest drinking-water, readily available at the place where analyses are to be made. Since such waters vary in alkalinity and in other properties that might affect the results, 10 cc. of the sulphuric acid is added to the 2600 cc. of water needed.

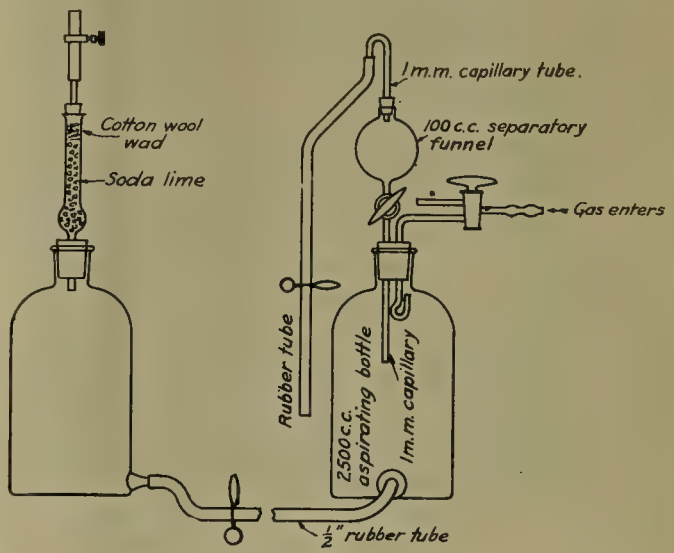


FIG. 1. SULPHUR DI-OXIDE APPARATUS

The 10 cc. of starch-solution is added to serve as indicator; 250 cc. of starch-solution was provided. This was made by mixing 50 grammes of starch to a paste with cold distilled water, diluting to 500 cc. with distilled water, boiling a few minutes, stirring meanwhile, then diluting to one litre with 500 cc. of distilled water containing 2 gm. of potassium iodide, and adding a few drops of chloroform as preservative. 250 cc. of thio-sulphate solution was provided. The strength was roughly 1/40 normal.

A bottle containing 250 cc. of chemically pure sulphuric acid, of 1.84 sp. gr., was provided; also one litre of distilled water.

One litre of iodine-solution was provided. This was approximately 5/100 normal, accurately standardized with arsenic tri-oxide. One cubic centimetre was roughly equivalent to 0.02% SO_2 when used in the apparatus.

PRELIMINARY OPERATIONS. Before taking a sample a few cubic centimetres of the iodine-solution are poured into the separatory funnel and shaken to wet the walls.

*Published by permission of the Director of the U. S. Bureau of Mines.

All the water in the aspirating-bottles is then titrated to the first distinct blue color. Trial during the preliminary work with this method showed that one to two drops of the solution sufficed to change the liquid from colorless to blue when the point of change had been reached. The point where the change occurs should be closely observed, and this amount for the actual color-change should not be exceeded. In case the end-point is over-run a few drops of the thio-sulphate solution may be added till colorless and the titration with iodine repeated till the exact end-point is found.

When the aspirating solution is titrated to the point of color-change the excess iodine is wasted onto the ground by allowing it to drain from the separatory funnel through the capillary tube for half a minute.

Taking the Samples. Two conditions may confront the operator in securing his samples. In the one case the operator is standing in the atmosphere that is to be analyzed. Here the method of sampling is obvious. In the other case the sample is to be taken from behind a wall or brattice.

In case the sample must be taken from behind a brattice, an opening is first to be provided. The rubber tube attached to the intake-end of the hand-pump is attached to a glass tube and the glass tube pushed through the opening. The end of the tube should extend at least a foot beyond the inside wall. The excess opening in the brattice should then be stopped with moist earth or a handkerchief. The rubber tube on the discharge end of the hand-pump is slipped over the tube and the cock turned so as to pump into the outside air. The pump should be worked about three minutes till the gas from behind the brattice fills all the tubes. Then the cock is turned so as to connect with the interior of the bottle.

The sample-bottle is held about three feet above the other to allow rapid transference of the water. On trial about 45 seconds was required for this. The bottom of the bottle should be held level and as much water allowed to flow out in this position as will. Calibration showed 2500 cc. + 10 cc. to the volume of gas sucked into the bottle under these conditions.

Determination of Sulphur Di-oxide. When the sample is secured 50 cc. of iodine solution, measured in the graduated cylinder, is poured into the separatory funnel and the rubber stopper replaced in the funnel. When handling the iodine solution in an atmosphere containing sulphur di-oxide it must be borne in mind that the atmosphere acts upon the reagent. Hence it should be protected as much as possible and handled rapidly when exposed. The free end of the small rubber tube connecting with the separatory funnel is taken between the teeth of the operator, the pinch-cock let down till the tube runs through the circle, pressure is blown upon the iodine solution as desired, and the tube pinched tight with the teeth. The titration is now made, during which the pressure on the iodine solution is increased or decreased as needed. During the titration the bottle is shaken vigorously so as to rinse all parts of the walls with the solution in the bottom. When the end-point is established half the displacing liquid is allowed to run back into the titrating-bottle. When the surrounding atmosphere contains sulphur di-oxide, this should be done rather slowly, the bottles being on the same level and the guard-tube securely in place, and its clamp opened. The water in the titrating-bottle is then again titrated to the end-point, after which the rubber stopper holding the separatory funnel is transferred to the other bottle and the other half of the water solution titrated to the exact end-point. This completes the titration. The residual iodine solution is run into the graduate, allowed to drain half a minute and the volume read. The difference between this and the original volume is the volume used in titrating.

In case the determination must be made in an atmosphere where breathing apparatus is necessary the pressure on the iodine solution in the separatory funnel may be made by means of the hand-pump and retained by means of the pinch-cock. In this case the extra guard-tube of soda-lime should be inserted between the funnel and the pump.

When less than 5 cc. of iodine solution is needed to make a titration it has been found best to repeat the experiment with a more dilute iodine solution. The funnel is rinsed with distilled water and drained; 5 cc. of iodine solution is measured into the graduate and distilled waste added to the 50 cc. mark. The solution is thoroughly mixed, poured into the separatory funnel, and the experiment repeated. Trial showed that a distinct end-point could be established in a dark room by the light of a flash-light with five drops or less of this dilute solution.

Calculation. The iodine solution should be standardized to read cubic centimetres of sulphur di-oxide at 760 mm. and 0° C. Changes in barometric pressure and temperature would affect the determinations, and for that reason must be taken into account in making the calculations. Standard conditions of 760 mm. barometric pressure and 0° C. temperature should be the basis for comparison of all analyses. Fig. 3 is a graph of factors to be used to reduce observed percentages to those at the standard conditions. An example will show how these are to be used: 11 cc. of iodine solution was used to titrate the SO_2 in a sample, the barometer stood at 720 mm. and the temperature was 15° C.; 1 cc. of the iodine solution was equivalent to 0.4327 cc. of sulphur di-oxide gas at standard conditions. What was the percentage of sulphur di-oxide in the gas when reduced to standard conditions?

$0.4327 \times 11 = 4.76$ cc. SO_2 at standard conditions.

$\frac{4.76}{(2500 = \text{vol. in analyzing-bottle})} \times 100 = 0.1904$ apparent percentages of SO_2.

1.055 is factor for 720 mm. from graph,

1.055 is factor for 15° C. from graph,

$0.1904 \times 1.055 \times 1.055 = 0.21\%$ SO_2 at standard conditions.

In doing the work, recording data, and making calculations it is best to carry through three significant figures. Then cut those beyond the nearest second significant figure when the calculation is completed. When the pro-

portion of sulphur di-oxide is below 1%, no accuracy beyond the two figures can be claimed for the method.

It is obvious that the calculation can be shortened when one set of apparatus and solutions is used continuously for analyses, by means of factors common to all calculations.

Tests of the method throughout its entire range were made by analyzing synthetic mixtures of air and sulphur di-oxide of known composition. The errors of measurement in forming the synthetic mixtures were as large or larger than those from the iodine determination. The results indicate not the absolute accuracy of the method but rather the fact that it may be depended upon to indicate sulphur di-oxide in air from a minimum of a few parts per million to 1% or more.

The method is fully as accurate as the most precise gastrometric methods within the range of laboratory apparatus; furthermore, it has a range extending down to a lower limit of about ten parts per million parts of gas. Though the range extends from this low figure of sulphur di-oxide to many thousand parts per million, it may be considered accurate only to two significant figures except in the higher ranges.

EFFECTS ON THE SENSES. During the experiments in the room containing sulphur di-oxide it was necessary to wear breathing-apparatus of the type used for mine-rescue purposes, in all but the lower concentrations. The apparatus had a mouth-piece for breathing and soft rubber-edged goggles, which readily conform to and fit the face, for protecting the eyes. The rubber parts of the goggles were wet and carefully adjusted to secure accurate fitting. The utmost care was necessary to have perfect adjustment especially in the higher concentrations of sulphur di-oxide. If such care was not taken the gas penetrated to the eyes, producing pain and blindness.

The observations made during the tests are arranged in order of increasing concentration of sulphur di-oxide in the following table:

Effects of sulphur di-oxide in various concentrations on the senses

Concentration by iodine method, %	Test No.	Observations
0.0037	26	No mask worn. Slight smarting in nose. Slight depression in breathing.
0.0037	25	No mask worn. Smarts in nose, slightly depressing to breathe.
0.0056	24	No mask worn. Smarting of nose, slightly difficult to breathe.
0.0074	23	No mask worn. Smarting of nose, shortness of breath, no discomfort to eyes.
0.011	22	No mask worn. Smarting of nose, shortness of breath, produced discomfort of eyes and flow of tears.
0.013	21	No mask worn. Smarting of eyes and nose. Makes shortness of breath. Could remain in room only with difficulty.
0.013	32	Taken without mask, but difficult. Had to close eyes most of time. Affected throat and lungs.
0.017	20	No mask worn. Smarts in nose and makes the eyes water. Could not remain in room.
0.024	19	Without mask could stay in room only short time. Produced choking and shortness of breath.
0.034	18	Without the mask the gas badly affected the eyes, nose, and lungs. Mask was worn to secure sample.
0.037	31	Without mask the gas bites passages in head and throat, breathing is very difficult, eyes smart a bit. Could endure it half a minute.
0.037	1	Smarted in eyes, etc. Mask was necessary to secure samples for analysis.
0.041	17	Mask was necessary.
0.052	16	Impossible to enter room without mask.
0.093	15	Impossible to enter room without mask.
0.10	29	.....
0.13	14	.....
0.13	11	Hurts small cut on finger.

FIG. 2. RECEPTACLE FOR PORTABLE SULPHUR DI-OXIDE APPARATUS

Concentration by iodine method, %	Test No.	Observations
0.15	28	
0.17	13	
0.19	10	Gas penetrated rubber goggles, smarted in eyes.
0.21	9	
0.25	12	
0.25	4	Gas penetrated goggles, blinding on eyes, had difficulty in securing samples.
0.26	3	With mask well adjusted, work could be done without difficulty.
0.30	8	
0.33	27	
0.36	2	
0.37	7	
0.50	6	Mask required good adjustment to keep out fumes.
0.87	5	

By referring to this table an estimate of the proportion of sulphur di-oxide in air may be made by an observer without analysis, and estimates even may be made for concentrations lower than those investigated. The lowest concentration of gas tested by analysis was about 40 parts per million. At this concentration the air had a biting effect on the mucus membrane of the nose. Undoubtedly at one-tenth of this concentration, or four parts per million, sulphur di-oxide would have a distinct odor.

Although experiments were not made with other gases that may be determined by means of iodimetry, the apparatus may be used to determine such gases as hydrogen sulphide, chlorine, oxides of nitrogen, and some others. In the case of chlorine and nitrogen oxides, iodine would be liberated in the water solution, which should contain some potassium iodide. The starch-iodine blue solution would then be titrated to colorless by means of a standard sodium thio-sulphate solution.

SUMMARY. A method and apparatus for determination of sulphur di-oxide by means of the iodine titration has been developed for the use of engineers working in the field. The apparatus is strong, cheap, easily replaceable, and assembled into a case designed for portability. The method is not accurate beyond two significant figures, but has a range from about ten parts per million by volume to 1% or more. Also, with the aid of the table giving the effect upon the senses of varying concentrations of SO_2, it is possible to estimate the small proportions of sulphur di-oxide without analysis.

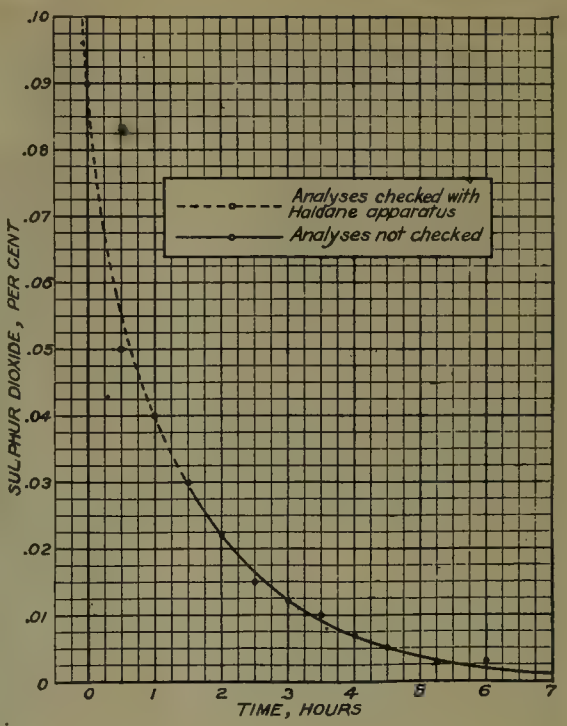


FIG. 4

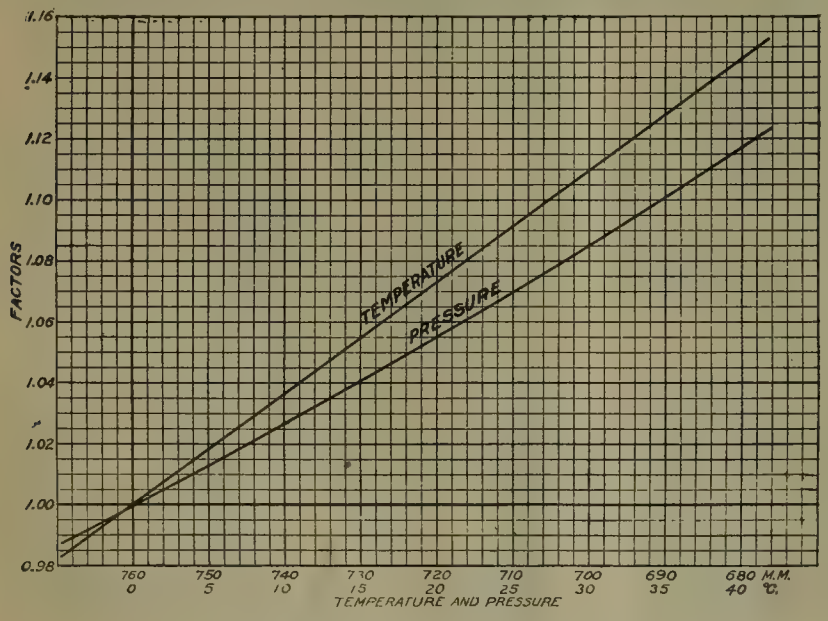


FIG. 3. GRAPH OF FACTORS USED IN SULPHUR DI-OXIDE CALCULATIONS

THE RELATION OF SULPHUR in the poling of copper, as brought out by the Stanislaus Skowronski, in Bull. A. I. M. E., is that of a direct agent in over-poling, the Cu_2O left in the copper acting only as a neutralizing agent for the sulphur. The sulphur automatically controls the amount of oxygen present in the refined copper. It is impossible to over-pole copper by over-reduction if the copper does not contain sulphur. The author concludes that, since no reliable data are at hand as to the actual effect of hydrogen and CO on over-poling, the above fact should be taken to indicate that in addition to the effect of sulphur there is probably an additional effect from H, or CO, or both.

Notes on the Cyanidation of Silver Ore at El Oro, Mexico

By F. A. MALINS

One day recently when passing the shaft of the Carmen de Virgenes mine (near the Dos Estrellas) in Michoacán, Mexico, I noticed a pile of ore that had a distinct canary-yellow color.

On investigation it appeared that the yellow color was due to sulphur. Much of the ore inside the pile showed argentite (silver sulphide), and this mineral, having been wetted by rain, had slowly decomposed; this, in conjunction with the air contained between the particles of mineral, had caused the decomposition of the argentite, with the formation of sulphuric acid and the precipitation of metallic silver, according to the following equation:

$$2Ag_2S + 3H_2O + 7O = 2H_2SO_4 + 4Ag + H_2O + O$$

The numerous crystals of argentite throughout the mass were all somewhat decomposed, some being lightly coated with a black sooty material, which appeared to be black amorphous metallic silver. Apparently the dilute sulphuric acid was, as might have been expected, slowly attacking this silver (the solution being cold), but, in the presence of other minerals in the gangue, it was also to some extent being itself decomposed, with separation of sulphur. If such acid were diluted sufficiently by the rain-water a large loss of silver might be caused by the solution of the silver sulphate.

It would appear therefore to be a good idea in a rainy country to keep ore carrying argentite under cover.

From the above chemical reactions another inference may be made:

If such argentite had been subjected while in the vein to a circulation or (slow but constant) passage of water carrying sufficient air through it, a portion of such silver sulphide would have been dissolved as silver sulphate and carried away with such water to its outlet, and so have been lost; or else while in solution, meeting other waters carrying the necessary salts, such as sodium chloride, it would have been precipitated as silver chloride at such point of meeting. But, evidently, the enclosing quartz was too impermeable to have permitted this, and the argentite has remained unchanged.

It appears certain that the silver in the oxidized ore of our Dos Estrellas mine is not (as believed by many) in the form of a silver sulphide, but rather in the amorphous metallic form partly annealed, and in the condition usually prevailing in most oxidized ores.

The silver after decomposition of the silver sulphide in the tube-mills would be in the black amorphous form. The silver in the oxidized ores, which show no free gold or silver, is in the amorphous form also, but, in addition, it is partly annealed, though not sufficiently to have a metallic lustre or to be visible to the naked eye.

The silver sulphide when present in the Dos Estrellas ore is so finely disseminated, and so much pyrrhotite and also ferroso-ferric sulphates (caused by decomposition of pyrrhotite) are present, that it is hard to detect the presence of such silver sulphide. It is, however, found occasionally in crystals of sufficient size to permit of identification.

The principal reasons for believing that these ores are generally oxidized are:

(*a*) If the silver were in the form of silver sulphide (in a small or reasonable amount) it would (as actually occurs with ores carrying argentite in the Dos Estrellas and in other parts of the district) be at once decomposed in the tube-mills owing to the intense agitation and aeration, aided by the considerable amount of heat produced, and also by the 'greta' (crude litharge) and lime fed to the mills, as well as by any zinc in solution, and this would cause all or the greater part of such silver (which, it should be remembered, would be in such case the black amorphous form freshly precipitated and consequently in the most soluble condition) to be dissolved by the free cyanide in such tube-mills. But this does not happen to a noteworthy extent. Not over 50% of the silver goes into solution in the tube-mills.

(*b*) The hydrocyanic acid in the cyanide, not being as strong an acid as the sulphuric, the solution of the amorphous partly annealed silver would be a question of time (as well as of fine grinding). And time has certainly proved to be necessary for good extraction.

Other reasons why long time is necessary are that not only is the hydrocyanic acid of the cyanide a weak acid as compared with other acids, but the solution of cyanide ordinarily used in the mill is very weak anyhow. In the Dos Estrellas mill we use a strength of only 0.06% KCN. Also the larger part of such silver is probably not in the true amorphous form, but has (as stated more fully later) been more or less annealed while lying for ages in the vein, thus making its solution by cyanide a matter of much greater difficulty, and one requiring a considerable amount of time.

This applies to the gold, but in less degree. The particles of gold are apparently finer than those of the silver, and go into solution more readily in the tube-mills. I am speaking here of partly annealed gold. The mill-ore at Dos Estrellas carries no free gold (annealed gold) visible to the naked eye.

But in addition to the silver sulphides and the free (though very fine and partly annealed) gold in the ore we have to deal with the gold and silver set free in the tube-mills, by joint chemical and mechanical action, from pyrrhotite, and also with the gold alloyed with silver, of which there is much in all the oxidized ore, forming the larger part of the metal to be extracted.

Now the pyrrhotite (which is the principal valuable sulphide mineral at Dos Estrellas) carries both, but in varying proportions. Such pyrrhotite as is decomposed by joint chemical and mechanical action in the tube-mills (in the same manner as silver sulphide is decomposed) gives up its gold and silver in the black amorphous form, to be dissolved promptly in the tube-mills. That part of the pyrrhotite which escapes decomposition in the tube-mills issues from them in a finely-divided state, and may perhaps give up a portion of its value during its four days' treatment by direct percolation of its particles by the cyanide.

At Cripple Creek, Colorado, some years ago (in 1894) I obtained some pieces of coarsely-crushed pyrite from a Battle Mountain ore that carried pyrite, but in it also were found pseudomorphs of gold in the cubic form, filling cavities originally occupied by pyrite. The ore carrying this pyrite had been treated with strong cyanide solution for 24 days in percolation vats at the Brodie mill.

On examining these crystals under a strong glass the polished sides seemed to show slight markings, which under the microscope proved to be an infinitesimal number of minute holes, blackish in color, apparently caused by the cyanide following in and dissolving out the gold. There were more of these markings in some places than others. These facts seemed to show that:

1. If time enough is given, cyanide will extract gold from pyrite (and probably also from pyrrhotite, as it is softer and usually richer) by direct percolation of each crystal.

2. The gold is not chemically united with the pyrite (or probably pyrrhotite also) as a sulphide of iron and gold, as has been believed by many people, but is contained in it as a mixture, the particles of gold lying side by side with the particles of pyrite.

(3) Such gold was not mixed evenly in the crystals, but there was more in some parts than in others.

There still remains the gold and silver alloy contained in the oxidized ores; the precious metals arrive in a more or less annealed form, as well as alloyed together, this annealing having occurred while in the vein. They are not soluble in cyanide as readily as the black amorphous metals freshly obtained from chemical deposition while in the tube-mills. The reverse obtains in the amalgamating-pan. Here the fact that the gold (or the gold and silver alloyed) is partly annealed, plus the further annealing caused in the pan owing to rubbing action, causes the metals to be easily assimilated by mercury.

These alloyed metals, as might be expected, are the most difficult to dissolve, because of their more annealed and consequently more solid and more compact form. If time enough could be given, it is probable that all or almost all could be dissolved, provided the crushing were fine enough; but this is impossible in practice.

It might be supposed that the continuous beating of such particles of metal against the sides of the tube-mill would anneal them and put them into leaf form, so that they would be soluble in cyanide in the presence of the air that is beaten into the solution, aided by the heat generated. But this does not happen notably, because, as mentioned before, not more than 50% of the total silver goes into solution in the tube-mills.

In my laboratory tests, made with a view to studying the form in which precious metals exist in the tailing, I have so far never been able to detect any precious metals in the tailing from the mill-ore of this mine except just pure gold and silver alloyed, with occasional particles of low-grade pyrrhotite. That they do exist in the tailing as an alloy is indicated too by the fact that whether the tailing be high or low it carries about the same proportion of gold to silver; and the fact that this gold is apparently refractory, and goes into solution at only the same rate as the silver, is due to the fact that they are intimately alloyed, and for that reason the gold cannot dissolve any faster than the silver; and silver is generally considered to require more time for its solution than gold.

It might be possible to reduce the loss in such tailing by strengthening the cyanide solution, or by giving a longer time for agitation, or both. Experiments show that by crushing all to pass a 200-mesh sieve a much larger recovery can be made, especially of the gold; but it is not economical to do so.

GOLD PRODUCTION of Western Australia, and labor employed, is as follows:

Year	Gold output	Men employed
1903	£8,335,579	17,329
1914	5,157,760	11,722
1915	5,078,155	10,598
1916	4,382,497	9,563
1917	4,066,860	8,529

The year 1903 was the period of greatest production, the decline setting in thereafter. The cost of producing gold at the Great Boulder mine in June was $9.75 per ounce, on 10,300 oz. extracted; at the Horse Shoe, $17.25; at the Sons of Gwalia, $18; Bullfinch, $19.25; and Ivanhoe, $16.50 per ounce.

ANTIMONY SULPHIDE is used largely as a constituent in military and sporting arms primers. It has been shown by A. S. Cushman that (1) the purity of liquated 'needle antimony' should be determined from its sulphur content, (2) purifying 'needle antimony' by tartaric acid is unjustifiable if not actually dangerous, (3) 'needle' Sb_2S_3, approximately 80% Sb_2O_3, is as efficient for the manufacture of primers as approximately 100% stibnite, (4) lead and iron sulphides work satisfactorily as substitutes for Sb_2S_3 in non-fulminate primers, (5) hence the presence of lead and iron sulphides in Sb_2S_3 is not harmful, (6) in case of a deficiency in the foreign supply of Sb_2S_3 the domestic supplies would serve, (7) primers made with PbS and FeS showed a higher velocity for normal pressure than Sb_2S_3.

Germany's Stolen Chemistry

By TOWNES R. LEIGH

*When we recall that Samson slew a thousand Philistines with the jawbone of an ass we intuitively wonder how many he would have slain if armed with the jawbone of a German propagandist, according to whom all things were made by Germans and without whom was not anything made that was made. To use a medical term, the modern Teuton seems to be suffering from what is known as paranoia, or the disease of an exaggerated ego. Yet, as much as the German has boasted, he has borrowed more; as much as he has talked, he has taken more. In times of peace he has seized upon the inventions and discoveries of is neighbors for exploitation, shouting as he did so, "They are mine." When chemicals and drugs have been mentioned he has waxed especially boisterous, puffed up his breast and roared, "They are mine." Indeed, they are not his any more than are the Belgians whom he has deported to till his fields and serve his forges. The first chemical works were established by Chaptal, near Montpelier, France. It is time to prick the inflated bubble of Germany's chemical reputation. I have before me a leading text-book of general chemistry, one taught in the foremost universities. Glancing down its index, my eye rests upon the word 'Law', followed by a list containing 21 fundamental laws by which the science of chemistry is governed. There I see the names of Avogadro, Boyle, Charles, Dalton, Dulong and Petit, Faraday, Gay-Lussac, Henry, Le Chatelier, Mendelejeff, down to van't Hoff—but nowhere do I see the name of a German. Italy, England, France, Russia, and Holland flash forth in the glory of their sons wherever the principles of chemistry go; but Germany did not discover one of these secrets of general chemistry. Liebig and Wöhler, who in the nineteenth century made important contributions to the branch of synthetic chemistry, received their training from the French. Germany talks fast and furiously about modern chemical industry and commerce with the hope that her clamor will cause the world to forget her debts; but, by the aid of Buckley's 'History of Natural Sciences', we see that of the 30 chief men of science of the seventeenth century only three were of German blood, and of the 27 of the eighteenth century again only three were German. During the nineteenth century the science of chemistry made greater progress than it had made in all its past history. The majority of the most important contributions to chemistry during the past century were not made by Germans. Not a component of the air he breathes was discovered by a German. Oxygen is credited to Priestley, an Englishman, who late in life settled in Pennsylvania; nitrogen, first recognized by Rutherford, a professor in Edinburgh University; carbon di-oxide, isolated by Black, a Scottish chemist and physicist; helium, krypton, xenon, and neon, discovered and first studied by British subjects—Lockyer, Ramsay, Crookes, and Rayleigh. Not an element in water was discovered by any German. Hydrogen was discovered by Cavendish, the noted English chemist, and oxygen, its other component, by Priestley, as we have already stated. Not an element in the salt with which we savor our food was discovered by any German. Its chlorine is a gift of that productive investigator, Scheele, a Sweede; its sodium, from the versatile Davy of London. The indictment which has been brought against German chemists concerning the elements in air, water, and salt may be extended to cover the elements found in 75,000 other substances, including nearly all of the synthetic compounds used in the world's trade.

There is probably no field in which synthetic chemistry has played so important a rôle as in the coal-tar dye industry. In 1739 Dr. Clayton, dean of Kildare, first distilled coal and obtained coke, tar, and gas. Less than 50 years later the Earl of Dundonald, a Scottish nobleman, obtained a patent for the extraction of coal-tar in commercial quantities. In 1792 William Murdock of England first used coal-gas as illuminant. Naphthalene, used chiefly in the manufacture of indigo, was discovered in 1820 by Garden; benzol, the parent substance of the most important dyes, was discovered in illuminating-gas in 1815 by Faraday; anthracene, largely used in the synthesis of Turkey-red, was first procured by Dumas of France; toluene, used both for making dyes and the powerful explosive T. N. T., was first obtained by Mansfield; and picric acid, also employed in the manufacture of dyes and explosives, was first prepared by Peter Woulfe, a London chemist.

In connection with these achievements, the importance of the miner's safety-lamp, invented in 1815 by Humphrey Davy, must not be overlooked, for by the use of that simple and ingenious device the danger and hazard of mining coal were largely removed. The great honor of producing the first coal-tar color belongs to W. H. Perkin, an English chemist, who, during the Easter vacation of 1856, tried some experiments. He planned to produce synthetically no less a substance than the valuable alkaloid, quinine. The attempt was a failure in so far as obtaining quinine was concerned, but he noticed that a colored product had been formed. The most interesting feature of his work was the quick perception he had of some possible value of the new substance. The dye was finally purified and given the name

*Abstract: Manufacturers Record.

mauve, by which it became familiar. For 50 years it was used in printing the English penny-postage stamp, by which means England maintained a unique memorial to her celebrated chemist, perpetuated even in the remotest part of the world, wherever her mail service may have penetrated. Not long after his first great discovery, Perkin perfected a method of manufacturing alizarin, with the result that the extraction of that dye from madder has been practically abandoned and the enormous acreage formerly devoted to the cultivation of that plant has been given over to cereals and other crops. After the synthesis of mauveine by Perkins, the synthetic-dye industry grew by leaps and bounds. Frequently methods for the preparation of the same dye were discovered independently by different chemists, and a common dye was sold under different names. For example, Verquin, a French chemist, manufactured fuchsine, and this same dye became known as magenta and rosaniline. In 1863 an Englishman by the name of Lightfoot produced aniline black, and in 1873 the first sulphur-dye was discovered by Croissant and Brittoniere of France. In connection with the development of dyestuffs, it should be recorded that to a French chemist is due the modern method of the preparation of the excellent bright-yellow dye for animal fibres. Another quality which this dye possesses is that it may be used for the detection of hemp, flax, and cotton in woolen goods, inasmuch as it does not color vegetable fibres.

Germany has exploited, but did not discover, coal-tar dyes. In 1913 she exported about 12 times as much synthetic color as was manufactured in the United States. Since the outbreak of the war American chemists and manufacturers have made far greater progress in the production of dyes than was ever made in Germany in the same length of time. It may be that America is destined to control the dye industry. At the present time a large percentage of the known coal-tar colors is being made in America, and already there is an investment of $200,000,000 for the production of colors and intermediates. American dyes have established their prestige in foreign markets, and in this respect the future is auspicious. The total domestic production of aniline dyes in 1915 was valued at $2,470,000. Our exports for the fiscal year 1917 of aniline and natural dyes were $11,710,887, an amount greater than the value of all the synthetic organic chemicals, including coal-tar dyes, imported annually into the United States before the War. Our total export of dyestuffs for the last calendar year amounted to upward of $15,000,000.

According to Leo H. Baekeland, the chewing-gum industry of the United States exceeded by several millions of dollars the value of all synthetic chemicals, dyestuffs included, imported every year into the United States. One single chain of five and ten-cent stores in 1913 exceeded by $11,000,000 the whole of the German synthetic dye industry throughout the world. In the same year the entire German color industry paid $11,000,000 in dividends, while one American company with a single standardized product—the Ford motor-car—did a greater annual business than all the German coal-tar dye plants together, with their 1200 different products, and earned four times their combined dividends while paying three times their wages.

As far as the mineral chemical industries are concerned, America, even before the War, could stand comparison with Germany or any other country. When it came to the production of acids and heavy chemicals, we were decidedly ahead of Germany. Especially was this true of our important electro-chemical industries.

The manufacture of synthetic dyes is only one of the many ideas that Germany borrowed from her more resourceful neighbors. The very chemicals which she uses to prosecute her war were not first produced by the subjects of the Kaiser. Howard, an English chemist, first made the fulminate of mercury; Schoenbein of Basel, Switzerland, guncotton in 1845; Sobrero of Turin, Italy, nitro-glycerine in 1846; Alfred Nobel of Sweden, dynamite in 1856 and blasting-gelatine in 1878; Veille of France, military smokeless powder in 1886; Alfred Abel of England, cordite; Egg, likewise an Englishman, devised the percussion cap; Picford, his compatriot, the safety-fuse, in 1831; and it was Venvenuto Cellini, an Italian, who introduced the blending process in gunpowder. Chlorine gas and a dozen other chemicals of modern warfare were not first 'Made in Germany'; and finally, we have it on the authority of Charles E. Munroe, a specialist on explosives, that out of 62 names of experts on explosives two stand supreme—that of Abel of England and of Bertholet of France.

Though Germans say much about the fixation of nitrogen, what credit do they deserve for its development? As long ago as 1784 the English chemist, Cavendish, observed that when electric sparks were passed through the air the oxides of nitrogen were formed, and by absorbing these oxides in water or in alkalies, nitric acid or nitrates could be produced. However, his discovery lay dormant until the demand for nitrates increased to such a degree that it became evident that the natural deposits of these substances were in danger of being exhausted before many years. In 1898, Sir William Crookes, president of the British Association, delivered the solemn warning that the years of plenty were passing and before long the greatly increased intensive cultivation would use up all the known sources of combined nitrogen and there would be no Egypt from whose granaries supplies could be obtained. Commercial chemistry was rapidly increasing its demands for nitrogen compounds in the manufacturing of dyes, explosives, ice, soda, and cyanides, the last being used in the extraction of gold from its ores and in the plating of metals, yet the source of supply of native nitrates showed no such elasticity. The Englishman's warning caused chemists and manufacturers to turn their attention to that important field. The first to solve successfully the problem of the combination of atmospheric nitrogen on a commercial scale were two Norwegians, Birkeland and Eyde. Other methods for the fixation of nitrogen commercially have since been developed. Our Government is

now spending millions of dollars in the construction of nitrate plants which are destined to place us in the forefront among the nations of the world in this particular field.

Few of the valuable chemical processes were developed by German brains. The Lablanc method of making soda-ash directly from salt was devised by a Frenchman in behalf of his country and named in his honor. The Solvay method, now more generally used, was perfected by a Belgian and bears his name. Soda-ash is employed in the manufacture of glass, soap, and many chemical reagents, and the enormous quantity of 2,250,000 tons is produced annually. The soda-process for making paper from wood-pulp was patented by Watt and Burgess of America. The sulphite process for the production of fats by steam at high temperature, largely used in the manufacture of soap, were the work of another American, R. A. Tilghman. The cyanide process of obtaining gold and silver was conceived by McArthur and Forest. The process of obtaining cheap aluminum was devised by C. M. Hall, also an American, while Cowles of Cleveland produced aluminum bronze. The process of making carborundum and graphite in commercial quantities was the work of E. G. Acheson. The French and the Americans were the first to manufacture ice by the use of liquid ammonia. The process of the softening of water was worked out by Clark of Aberdeen, Scotland. The filtration of water for public use was first carried out by James Simpson of the Chelsea waterworks, London, England. The de-colorizing power of vegetal charcoal was first noticed by Lowitz of St. Petersburg, and that of animal charcoal, the basis of the modern refinery, by Figuier of Montpelier, France. The process of hardening fats by the use of hydrogen we owe chiefly to an English firm, Messrs. Crossfield & Son. By their process whale-oil is now converted by large amounts into solid material suitable for the manufacturing of soap. The important contact-process, which is largely used in the manufacture of sulphuric acid, has been developed upon the observation made as far back as 1831 by P. Phillips, a vinegar merchant of Bristol, that the oxidation of sulphur di-oxide is greatly accelerated by the presence of platinum. The Englishman, John Mercer, taught us to mercerize cotton; the Frenchman, Chardonet, the process of making artificial silk. This method, however, by which most of the imitation or artificial silk is made at the present time is the viscose process, invented by the English chemists, Crass and Bevan, in which wood-pulp is used. H. Mege of France gave us oleomargarine; malted and condensed milks are distinctively American-born and developed products. Hyatt of America gave to the world celluloid.

To M. Verneuil of Paris we are indebted for the artificial ruby, the real ruby of science, which is as much the ruby of Ceylon and Burmah as is the water formed by burning hydrogen the water of the rain—identical in property and composition. In a small factory in the Rue Lafayette is to be found the commercial production of rubies on so cheap a scale as to decree the doom of the ruby mine, a doom as certain as that decreed by the synthetic dye to the indigo industry of India. To Henri Moissan of the Sorbonne, who produced tiny artificial diamonds, belongs the honor of the art and practice of electro-metallurgy, for, while other men have done things before and after his work, he made 300 contributions of new substances in the electro-metallurgical field. In the ever-widening circle of factories that surround Niagara Falls are to be found the greatest high-temperature industries in the world.

Very different from the dye, explosives, and other synthetic products just described is the remarkable substance produced by the American chemist, L. W. Baekeland, and which has quickly acquired a great industrial value. This substance, called Baekelite, is synthesized from phenol and formaldehyde; it is infusible, insoluble, an excellent substitute for amber, the best of insulators for electricity, and, though more durable than celluloid, it is not inflammable and is less expensive.

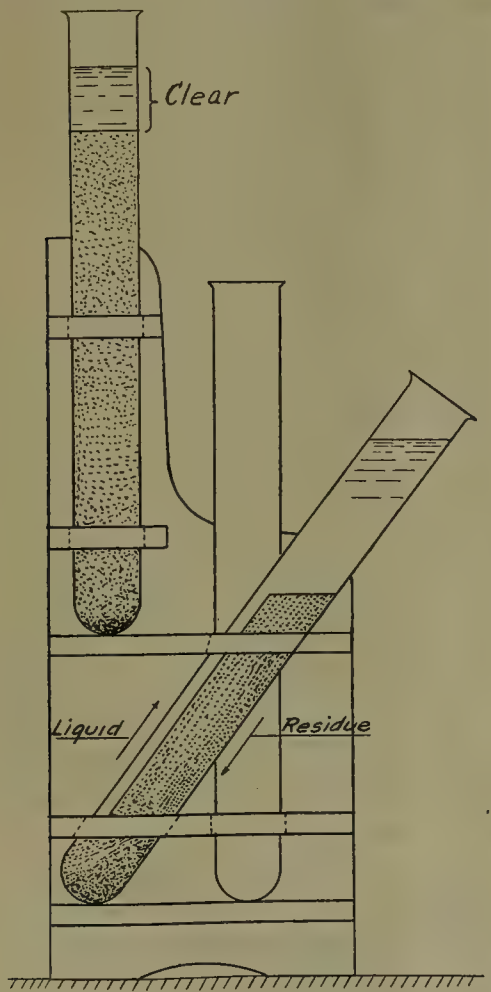
LEAD ROOFING was found by J. S. S. Brame, as stated in the 'Journal of the Society of Chemical Industry', to be corroded only where in contact with oak beams, and not at all where in contact with pine roofing. The composition of the corroded part was identical with that of common white lead. It has been previously recognized that in constructing sulphuric-acid chambers, lead and oak should not come into contact, perhaps on account of the acetic acid in the green oak. In a second case, lead roofing in contact with a coke-breeze concrete corroded fairly rapidly. The corrosion-product was red in color and contained a higher oxide than PbO. The action is probably due to the presence of hydrated lime in the cement. It has been suggested by others that calcium plumbite or plumbate might be the initial product formed. It was pointed out that the action was well known to plumbers and to cable companies, though never fully explained. It might be due to the presence of small amounts of free alkali. Metallic lead should never be used in contact with lime, mortar, or cement. The corrosion-product, is, however, generally white in color and contains no higher oxide of lead.

THE New Zealand Quicksilver Mines Co.'s property, formerly known as the Whangarei Cinnabar Co., is situated in the Whangarei district, 90 miles north of Auckland. At the outcrop the ore-shoot measured 30 ft. along the strike in the lowest workings. As far as proved it is 150 ft. in length, and still persists. The average width is 3½ ft. with a dip of 35°. The average from 310 tons treated is 2% mercury. The ore is calcined in a small Novak shaft-furnace. The total output is 11,000 lb. Owing to war conditions and the scarcity of labor the property is only being worked in a small way. The company holds an area of 450 acres, and cinnabar can be found in various places over a length of over half a mile beyond existing workings. Negotiations are under way to secure additional capital to develop fully the property.

Decanting

By H. TILLISCH

The decanting of liquids from residues is generally a tedious operation. The time required for the separation can be much abbreviated without mechanical means, if the tube simply be held in an inclined position, at an angle of 45°. The liquid will then form a channel in the upper part of the tube, while the residue will go along the under part to the bottom. In this way the two



RAPID SETTLING BY INCLINED TEST-TUBE

currents, upward and downward, will be separated from each other. The decantation can thus be finished in one-third the time required by the usual method with vertical tubes. It is common practice to use narrow inclined tubes for obtaining a rapid decanting in liquids or for separating dust from air. The same principle can, as shown, be of use in the laboratory. The common tube holders ought to be slightly modified for easy decanting in inclined tubes. The modification is suggested in the diagram.

[The method described by Mr. Tillisch is not new, but perhaps is not widely known. Better results are obtained when the tube is inclined at an angle of 60°. The principle is that the solid in suspension has but a short distance to fall before coming to rest, and its settling is not affected by eddies or cross-currents. As soon as it has reached the inclined tube-wall it slides downward. The rising current is induced by this motion, but, its velocity being due to displacement, it lacks the power to pick up the substance that displaced the water. Therefore the sediment accumulates at the bottom of the tube. This principle has long been applied in the inclined-baffle settling tank used in the metallurgical and chemical industries. Descriptions of the apparatus may be found in Richards' 'Ore Dressing' and other treatises on concentration.—EDITOR.]

AMMONIA has been oxidized to HNO_3 in quantity at the plant of the Gas Light & Coke Co. at Beckton, England. Experiments with several types of platinum catalysts led to the utilization of four layers of platinum gauze pressed tightly together and fitted into an aluminum frame with asbestos gaskets. There is first inserted under the gauze a platinum coil carrying a small current that heats it to redness and brings about the reaction with the assistance of a little auxiliary NH_3 to enrich the mixture. Once under way the reaction sustains the required heat in the gauze. Air is provided in the ratio of about 10 volumes to 1 of NH_3 by a Keith-Blackman blower at 6 inches of water-pressure. The NH_3 gas, after passing through a Bryan-Donkin reducing-valve, passes through the regulating-valve and a specially constructed Thorpe's meter, thence into the air-pipe and to the converters. The rate of flow of the mixture is carefully adjusted to keep the gauze hot, but with sufficient velocity to let any NH_3 pass through unconverted. The normal percentage of efficiency is better than 90.—'Gas World.'

POTASH production for the first six months of 1918, according to the U. S. Geological Survey, shows a total output of 20,000 to 25,000 short tons of pure potash (K_2O), indicating that the output for the entire year may reach 50,000 to 60,000 tons. As only 32,573 tons was produced in 1917, production is evidently increasing rapidly. The domestic production now equals 20 to 25% of the normal domestic consumption before the War, which is estimated to have been about 240.000 tons. The statistics for the first half of the year are not complete, as returns have not yet been received from a few large producers, and it is possible that the production in 1918 may exceed 60,000 tons, for reports made to the Survey indicate that a number of new enterprises may be put into operation during the second half of the year.

GOLD PRODUCTION of the Rand for the first half of 1918 compares as follows with the same period of 1917:

	Half-year, 1918	Half-year, 1917
Ounces	4,256,334	4,418,298
Value	£18,079,762	£18,767,732

Californian Mining in 1918

*In almost every year since the days of the forty-niners, California has led all others in the production of gold, and its total output to the end of 1917—$1,672,681,941—is far greater than that of any other State; yet, according to C. G. Yale, of the U. S. Geological Survey, the output of gold in the State is decreasing from month to month. This decrease is due not so much to the exhaustion of the placers, orebodies, or veins, as to war conditions, including the loss of miners, for many who formerly worked in gold mines are now prospecting or mining metals and minerals that are immediately needed to make munitions of war. Gold mining seems to be the only mineral industry that is losing ground in California, for the value of the total mineral output of the State is now greater than ever before.

During the first six months of 1918 the U. S. Mint at San Francisco, and the local smelters and refiners, to which most of the newly mined gold in California is sent, received from mines in the State $1,174,500 less gold than during the first six months of 1917. Moreover, the decrease in the output for the last half of the year is likely to be still greater, for many mines are closing down or are curtailing operations.

The output of the deep or quartz mines, in 1917, dropped 14 to 20%, and was still further reduced during the first half of 1918. The output of the placers, especially of the dredges, was increased about 6% in 1917, but will decrease in 1918. The dredges now produce more than 90% of the placer gold of California. The deep or quartz mines, which formerly produced 62 to 64% of the total gold, are now producing about 55%, and at the end of 1918 will be producing still less. Skilled labor in the mines not only costs more but is harder to get and keep, as many of the best men have gone into shipbuilding or other industries, where higher wages are paid. Thousands of the younger men have gone into the Army or Navy. All the operators complain that they are compelled to employ old men and boys, who are much less efficient than the men who have left. The output of ore is therefore materially reduced. Copper mining has been so prosperous that gold miners of the better class have been attracted to that industry, not only in California but in Nevada, Arizona, and other States.

In the Grass Valley district, Nevada county, the most productive deep-mine gold district in California, the cost of mining and milling ore is said to be $1.15 per ton more in 1918 than it was in 1917. The average value of the ores mined in that district is the highest in the State, yet the average value per ton of the ores from fourteen of the mines was only $7.84 in 1917 as compared with $9.10 in 1916. The profit at the mines in the Mother Lode counties, which supply 46% of the total milling ore, is very small, for the ores are generally of low grade. In 1917 the mines in these counties produced 1,236,903 tons of ore, which yielded an average of $4.19 per ton. Although an immense quantity of ore was milled, the increased costs and the narrow margin of profit have compelled several mines to close and others to curtail operations. If the operators of such mines can manage for a time to make their receipts balance their expenses they will be satisfied, for the cost of re-opening a large mine may be absolutely prohibitive. The manager of one of the larger Mother Lode mines, which produces an average of $700,000 per year in gold, has calculated his costs per ounce in gold, instead of per ton of ore, and he finds that the gold from his mine cost him $12 per ounce in 1915, $14 in 1916, $16 in 1917, and about $20 in 1918.

In Amador county the South Eureka Co. has permanently discontinued work on the South Eureka and the Oneida mines, both of which have been worked for many years. The Argonaut shaft is being sunk to a depth of 5000 ft. In Butte county the Pacific Gold Dredging Co. has worked out its ground in the Oroville district, although it is still working in other districts. In Calaveras county work at a number of placer mines, including those of the Stockton Ridge Co., has temporarily been discontinued. In Marin county the Chetco copper mine has become a producer after 40 years of idleness. In Mariposa county new equipment has been placed on the Mount Gaines group and changes have been made in milling to reduce costs. In Nevada county the old McGuire hydraulic mines at Lowell Hill, near Dutch Flat, are under new ownership, and a concrete dam to retain the tailing is to be built on Bear river. In Shasta county a new dredge has been set to work on Clear creek 3 miles below Redding. The American Dredge Co. has bought 1000 acres of the Menzer ranch, near Redding, at the mouth of Middle creek, where dredging was once profitable. In Sierra county the Brandy City Hydraulic Mines Co. is building a concrete débris dam at Bullards Bar, on North Yuba river. After an idleness of about 30 years the hydraulic mines at St. Louis and Howland Flat resumed work by building a big débris dam on Slate creek near American House. The placers at Poverty Hill and near Port Wine will be reached by a tunnel. In Siskiyou county the work at placers on Orleans bar and in other places was reduced this year, owing to scarcity of water. The Hazel gold mines, near Hornbrook, were re-opened and newly equipped after having been shut-down four years. In Trinity county the Trinity Star Dredging Co., at Lewiston, suspended work on its boat owing to shortage of labor and other adversities. The largest gold dredge in the northern part

*U. S. Geological Survey Bulletin.

of the State, owned by the Pacific Gold Dredging Co. at Carrville, on Coffee creek, ceased work entirely about the end of June. The Trinity Gold Mining Co., which owns the Headlight mine at Trinity Center, has found work unprofitable and has dismantled its 40-stamp mill and 200-ton cyanide plant. The Estabrook Dredge Co. has abandoned its smaller dredge at Trinity Center but will build a new one. In Tuolumne county the Eagle-Shawmut mine, owned by the Belmont Co. of Nevada, has put in ball-mills in addition to its 70 stamps, and has also added a flotation plant.

Most of the silver output of California is derived from copper and lead ores, although the gold bullion from deep and placer mines also yields silver. In the first six months of 1918 the output of silver was about 32,000 oz. less than in the corresponding period of 1917. Renewed activity, however, in the old silver camps of Darwin, Keeler, Calico, and other places in the southern part of the State is apparent since the rise in the price of silver.

During the first half of 1918 copper, lead, and zinc mining in California have been much more active. In 1917, as compared with 1916, there was a decrease of about 14% in the output of copper and of 2.9% in zinc, but an increase of 7.6% in lead. The only one of these metals that appears to show an increase during the first six months of 1918 is zinc. One of the largest copper mines, which had 700 men underground last year, has lately been employing less than 200. High cost of transportation has closed the Afterthought copper mine, in Shasta county and the Gray Eagle mine, in Siskiyou county. In the Blue Ledge region, in Siskiyou county, considerable copper has been mined, but restriction on transportation has hampered work. The Mountain Copper Co. has doubled the capacity of its flotation plant at Minnesota. The Bully Hill mine, in Shasta county, is concentrating by flotation. The Engels mine, in Plumas county, has enlarged its flotation plant, and the Walker mine, in the same county, is now operated by the Anaconda Copper Co., of Montana, which is shipping flotation concentrates to Tacoma. Copper mining is active in the region adjacent to Smartville, Yuba county, and Spenceville, Nevada county. Shasta county has taken the lead in the production of zinc in California, and, all minerals considered, it continues to be the most productive county in the State. A large quantity of zinc is also being produced in Inyo county.

Platinum has been actively sought and saved in California this year, principally at the gold dredges, where it has been recovered in larger quantities by improved appliances.

Metal Mines of Oregon in 1918

Receipts from Oregon at the Mint, smelters, and refineries at San Francisco show a decrease of $122,000 in gold and 13,000 oz. of silver for the first six months of 1918 as compared with the corresponding period of 1917, according to Charles G. Yale, U. S. Geological Survey. By no means all the gold and silver mined in Oregon is sent to San Francisco, but the proportion that is sent indicates the condition of the mining industry of the State. Oregon, like the other Western States, has been forced to reduce its output of gold by the present high cost of supplies, the scarcity of skilled labor, high freights, lack of investors in gold-mining enterprises, etc.

The statistics for 1917 showed a material reduction in the output of the metal mines in Oregon as compared with that of 1916. The quantity of ore taken from the deep mines was materially reduced, and the production of gold decreased more than 25%. The production of silver also decreased, and more than 30% less copper was produced than in 1916. There are now only between 70 and 80 producing mines in Oregon, most of them placer mines. Baker and Grant counties are the leading producers in the State and they have gained their position by dredging, yet even the dredges, hydraulic mines, and drift and surface-placer mines are making a reduced output, but the greatest deficit is in the production from the deep or quartz mines.

In the Gold Hill region the shortage of skilled miners and millmen has prevented resumption of work at the Millionaire, Nellie Wright, and some smaller mines in the district. The lessees of the Sylvanite mine bought the 10-stamp mill of the Gray Eagle and transferred it to the Sylvanite. The McKinley copper mines, consisting of twelve claims 12 miles east of Gold Beach, have been sold to the Takilma Smelting Co. The Chiles Mining Co., operating the Emery gold mine, 12 miles east of Harbor, was forced to close this year owing to the difficulty in procuring supplies, principally gasoline. The once productive Ben Harrison mine, in Baker county, which was under option, was returned to the original owners after the holders of the option had spent considerable money in investigating it. The Mountain Lion mine, 12 miles south-west of Grants Pass, has been sold, and the new owners will put in Lane mills. Improvements and larger reduction-works are being installed at the Almeda copper mines, on Rogue river 27 miles below Grants Pass. The Gold Bar mine, on Rogue river below Grants Pass, operated three hydraulic giants and a steam-shovel this year. The average value of the ore mined in Oregon and the quantity of ore treated is less than in former years. In the south-western counties of Oregon, which form a continuation of the Californian gold belt—Coos, Curry, Douglas, Jackson, Josephine, and Lane—a reduced output from both placers and deep mines is apparent, and some of the mines have been closed. The metal-producing counties in north-eastern Oregon are Baker, Crook, Giant, Malheur, and Wheeler, and, of the gold output of these counties, Baker has contributed about 94%. The output of gold from placers in these counties in 1917 was 14% less than in 1916, and that from lode mines was 25% less. Baker county shows the largest decrease in output, but Grant county, owing to the work of a new dredging enterprise, shows a material increase in the production of gold. The outstanding feature of metal mining in Oregon is the reduction in the number of productive mines, which was 29% less in 1917 than in 1916.

PLATTEVILLE, WISCONSIN

Zinc, Lead, and Pyrite Markets During August.

Prospects for a satisfactory month were not too brilliant at the beginning of August, but as time passed much improvement was shown over the July returns, and the past month was one of the best this year. Prices for zinc ore at the beginning were unsatisfactory, but they got better about mid-month, and considering all sales made the average was fair. Standard grades of concentrate, assaying under 60% zinc, ranged from $50 to $55 per ton, the latter figure being reached in the last week. Second-grades were classed at 52%, below which buyers established a lower basis of calculation. The low-grade products diverted to refiners were in better demand; and 30% ore, the basis, was bid in at $22.50, at which price a fair quantity of the reserve in the field was sold.

The most interesting news during the month came from a prominent producer, who stated that buyers of low-grade zinc ore, connected with the two acid plants being built in the field, had tried to obtain the output of his mines under contract arrangements, and that a new basis of settlement was proposed; that not only would payment be made for the zinc content of the ore at prevailing rates, but payment would also be made for the sulphur content of the ore. In other words, that which heretofore had been penalized would now afford a premium. Miners who have been selling low-grade zinc ore seemed delighted over the chance to dispose of ores on such a basis.

Labor conditions improved little. Skilled men were in good demand, and large producers claimed that their desires for this class of miner had been satisfied. Wages were increased at several points, and many farmers returned to the mines as soon as the harvest was over, attracted by the increased pay. There was little prospecting work carried out anywhere. Several new mills were started, and fully-developed new mines took the place of old producers. In the Linden district all the mines were completely shutdown, three out of ten producers having been abandoned permanently. In the Benton district several large mines operated with reduced forces. The maximum monthly capacity of the field, conservatively placed at 6000 short tons, under favorable conditions, has been reduced to 55%, at which point it is likely to be held until demand for ore improves, as well as prices. Power-plants demanding increased rates before the State Industrial Commission, had their demands granted, but not until operators had protested to their limits.

Lead producers fared exceptionally well, prices for August continuing at the $100 per ton basis of 80% metal, above which price buyers refused to advance. Not until the close of August were reports current that slightly better offerings had been made; but this developed on premium-grade lead concentrate. Production was better, on account of the increased milling of zinc ore and the output from several exclusively lead mines. A careful estimate showed over 1500 tons held in reserve at the close of the month. Some outside buying influence came into the field, but most of the ore was secured by the Federal Lead Company.

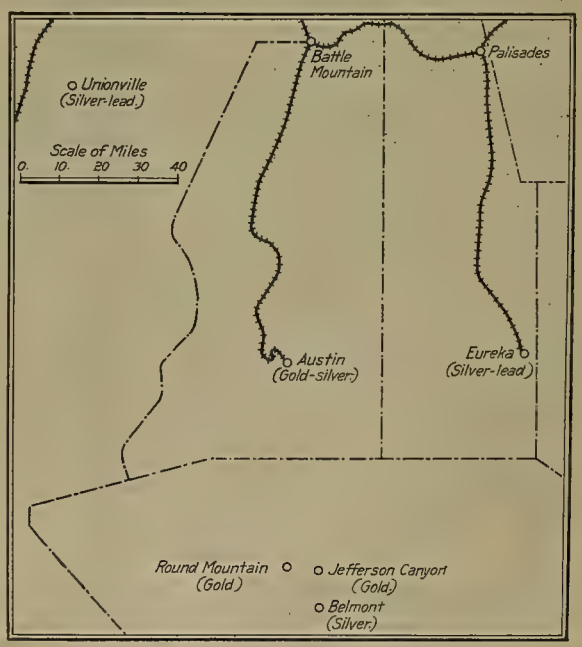
Shipments of iron pyrite came almost entirely from the zinc-ore separating-plants. Open-market sellers fared to better advantage than those selling under contract, the price paid being 25c. per unit, per long ton. Miners thinking that two new acid plants would make a demand for this class of ore in the Wisconsin field were given little encouragement, as the acid-making process to be employed uses sulphur fume from low-grade zinc ore. The quota of pyrite now sent out of the field to concerns not engaged in ore separation will have to be made up, so it appears that there will be a market for independent producers later on.

Deliveries of ores from mines to refining-plants in the field, and from mines to smelters direct, for August were as follows: 16,581 tons of blende, 704 tons of lead, and 3339 tons of pyrite. Shipments of high-grade separator product, made in the field, was shipped in larger quantities, totaling 9020 tons.

RENO, NEVADA

Development in the Eureka, Jefferson Canyon, Pioche, Peavine, Unionville, and Goldfield Districts.

Old mines of the Eureka district are being re-opened, largely through operations of the Eureka-Croesus company,



CENTRAL NEVADA, SHOWING DISTRICTS BEING REVIVED

which has secured title to a number of the early-day producers. In August it shipped ore to the value of $75,000, according to receipts from the sampler. Development is said to have exposed large bodies of high-grade milling-ore, and a flotation plant of large capacity is proposed. Eureka is credited with a production second only to the Comstock

among Nevada silver-mining districts, and during the busy period early records show that the minimum value of ore extracted was $30 per ton.

At Jefferson canyon, in Nye county, the Jefferson Gold & Copper Co., working the old Kanrohat mine, will discontinue the use of flotation and will restore the cyanide plant, having obtained far better results with the latter process. The change will involve extensive construction of launders to convey the tailing and waste solution out of the canyon in which the mill stands, in order to avoid damage to the Round Mountain water-rights. The manager, S. H. Brady, who is in New York, reports that a large tonnage of high-grade milling-ore has been blocked out by four tunnels, the deepest giving backs of 1000 ft. on the vein. The Kanrohat and adjoining mines were large producers of silver many years ago, but were developed only by shallow workings and were able to market only the richest ore.

At Pioche the Virginia-Louise mine is shipping ore to a smelter in Utah. The present rate is two carloads daily. A large amount of work has been done, and the manager reports a substantial tonnage of marketable ore available.

Recent work in the Peavine district near Reno, in Washoe county, is said to have resulted in opening a considerable quantity of milling-ore. Exploitation hitherto has been confined chiefly to surface prospecting, with rather unfavorable results.

Mine and mill equipment is being hauled to the old Arizona mine at Unionville, in southern Humboldt county, now being worked by the Sunset Mining & Development Co., under the management of F. W. Lockman. Some of the early-day mine workings are still in such shape that they can be re-opened. The mine has been drained to a depth of 400 ft. by a tunnel, giving access to the veins below the deepest of the old drifts and stopes. The mill now under construction will be equipped with stamps, tube-mills, and flotation apparatus.

At Goldfield recent development in the ground of the C. O. D. Consolidated company is considered among the most important of late. Part of this property, including most of the Gold Bar claim and part of the Victor, is being worked under lease by a group of Goldfield men. The manager is E. A. Ludwick, well known in Nevada. Working from a 125-ft. winze below an east drift from the Gold Bar shaft on the 65-ft. level, the lessees have opened an orebody for a distance of 35 ft., varying in width from 5 to 12 ft. Ludwick says that his lowest assay from this ore is $84, and that he has broken two carloads of $200 ore, in addition to 75 sacks of high-grade, some of which assays over $1 per pound. Ore sacks were not available at Goldfield, and the lessees were compelled to buy canvas and make their sacks. On the 200-ft. level they have exposed ore said to assay from $30 to $70 for a distance of 200 ft., and have a carload of this ore ready to ship. A merger of the C. O. D. and Blue Bull companies was proposed a year ago, together with a project to sink a 3000-ft. shaft on the latter property. This plan was abandoned because of war conditions, but is still being considered.

TORONTO, ONTARIO

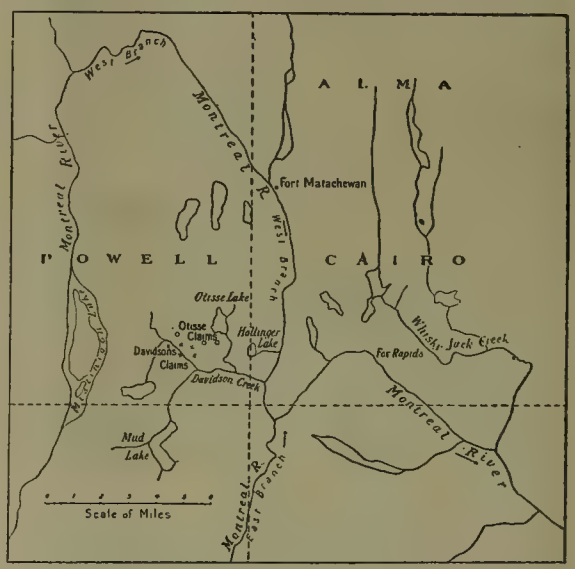
Price of Powder Doubled.—Notes from Porcupine, Matachewan, Boston Creek, and Cobalt.

The price of blasting-powder is a heavy charge that affects gold mining, and has much to do with the present depressed condition of the industry. The price of powder has doubled within the last five years. According to a statement by one of the gold-mining companies, the ruling price on 40% powder, that mostly used, has risen from $13.10 per 100 lb. in February 1913 to $26.70, or double. Mine-owners may request the Government to investigate the matter in hope of obtaining relief.

Boston Creek.—Great progress is being made here. The Miller-Independence has opened a vein carrying calaverite (telluride of gold). The vein is 11 ft. wide, said to average $300 per ton over this width. The shaft is down 100 ft., and ore has been exposed by drifts for 65 ft. The adjoining claims owned by S. J. Renaud, A. B. Cullen, and Peter McGinley, have been taken over on option by R. W. Norrington, representing Detroit interests, the price being reported as $250,000. Another adjacent property has been bought by Charles Millar and C. A. Gentles, of Toronto, for $25,000. It is understood that active exploration of both these properties will be started at once.——The Mekks Syndicate is making preparations for development.

Cobalt.—The Mining Corporation has taken over the Ophir Cobalt mine under an option to purchase a two-thirds interest for $150,000, agreeing to spend not less than $2500 per month on development.

Matachewan.—This goldfield is the principal centre of attraction at present, owing to recent rich discoveries. The most important was found in trenching and sinking test-pits on four claims south of the Otisse, which are being worked by the Nipissing company of Cobalt. A mass of gold was taken out, valued at $600. The Otisse is the only property on which any considerable amount of exploration has been accomplished. Six diamond-drill holes have been bored, the deepest being 600 ft. Machinery has been put in, and shaft-sinking will begin shortly. Some high-grade ore has been extracted from surface operations.



SKETCH OF MATACHEWAN GOLD DISTRICT, ONTARIO. PORCUPINE IS 45 MILES NORTH-WEST; BOSTON CREEK IS 35 MILES EAST; COBALT IS 65 MILES SOUTH-EAST.

Porcupine.—At the Dome Mines, development on the 1250-ft. level is progressing steadily with satisfactory results. A raise is being driven to the upper workings, an indication that the expected orebody has been found; but the management is reticent.

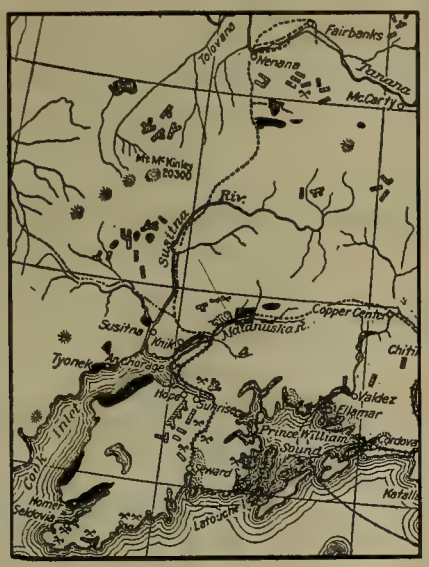
At the Davidson a new section is being developed. A second shaft is being sunk to 750 ft. from a point 300 ft. north of No. 1. Diamond-drilling discovered an orebody at a depth of 544 ft. It was 30 ft. wide, giving high assays.

The contract under which underground work on the Thompson-Krist is being carried on from the adjoining Vipond-North Thompson mine has almost expired, and as the latter company is doing no work in its own property, the contract is not likely to be renewed.

THE MINING SUMMARY

ALASKA

Anchorage.—The railway between this place and Seward is complete. Some difficult engineering was overcome in



PART OF ALASKA, SHOWING RAILROAD ROUTES.

construction. Coal from the Matanuska field can now be hauled to Seward, a distance of 190 miles. The Department of the Interior states that 60% of the Alaskan Railroad is finished.

ARIZONA

Ajo.—New Cornelia produced 3,928,000 lb. of copper in August, a gain of 28,000 lb. on July.

Bisbee.—Phelps Dodge Corporation pays $8 per share on September 30. This makes $22 for 1918.

The number of applicants for loans from the mining companies to build homes in the Warren district under the new plan has so far exceeded expectations.

Clifton.—Arizona Copper Co. produced 4,300,000 lb. in August, 3,000,000 lb. more than in July.

Globe.—The Iron Cap Copper Co. pays 25c. per share on October 1. This amounts to $28,130.

Jerome.—It is reported that steam-shovel operations are to take place on top the the United Verde orebody. A contract has been let for construction of a two-mile railway to the area. All buildings on the proposed site are to be removed.

Tucson.—Rifle and artillery range wastage, amounting to 35 tons, has been shipped to Tucson for reduction at the Arizona Rare Metals Co.'s plant, which has been altered to treat such material. This plant closed down after the slump in molybdenum.

CALIFORNIA

Bishop.—It is reported that George Brown and others have sold 69 claims, 10 miles west of Brown station, to George Wingfield and others, for a large sum. The property contains large deposits of low-grade gold ore. Seventeen men are employed. An auto-road is being constructed.

Eureka.—According to the 'Humboldt Standard' of September 16, W. B. Thompson, well known in mining circles, has suggested construction of a railway between Hornbrook and Yreka in Siskiyou county, along the Klamath river, possibly connecting with either Eureka or Crescent on the coast. The length would be 270 miles. The line would pass through the chrome and gold areas, also a great timber belt.

Idria.—The New Idria Quicksilver Co. pays 50c. per share on October 1, equal to $50,000.

Plymouth.—The Plymouth Consolidated reports as follows for July:

Ore treated, tons	11,000
Yield, including concentrates	$62,000
Working expenses	34,000
Development charges	8,200
Surplus	20,000
Capital expenditure	3,600

The following is an extract from the superintendent's (J. F. Parks) mailed report regarding development for the month of June: 2600-ft. level: north foot-wall drift extended 75 ft. (total 521 ft.); assays averaged $2.22 per ton for a width of 4 ft. 5 in.—2150-ft. level: north foot-wall drift extended 69 ft. (total 744 ft.); formation was slate and sandstone.—2000-ft. level: north foot-wall drift extended 47 ft. (total 402 ft.); formation was foot-wall slate.—1500-ft. level: east branch drift off south drift extended 82 ft. (total 146 ft.); 19 ft. of which averaged $13.70 per ton for a width of 1 ft. 6 in.—1400-ft. level: rise at 617 ft. south extended 50 ft. (total 106 ft.); assays averaged $8.80 per ton for a width of 5 ft. 7 in. East branch drift south started at 642 ft. south and advanced 8 ft.; assays averaged $7 per ton for a width of 3 ft.—1200-ft. level: main south drift extended 106 ft. (total 1632 ft.); assays averaged 90 cents per ton for a width of 3 ft. 1 in.—1065-ft. level: rise at 855 ft. south started and put up 39 ft.; assays averaged $4.30 per ton for a width of 3 ft. 2 in.—950-ft. level: rise at 972 ft. south started and put up 46 ft., the last 4 ft. averaging $9 per ton for a width of 1 foot.

On August 27 the London office of the company reported that on the 1500-ft. level, the south shoot of ore had been exposed 90 ft. long, and 54 in. wide, averaging $11 per ton. The face was 96 in. wide.

Winthrop.—The management of the Bully Hill mine announces that the new flotation plant will be ready to start early in October.

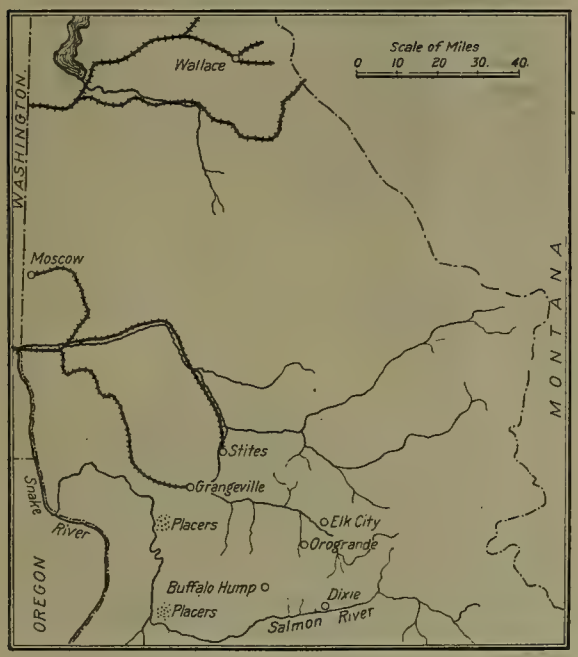
COLORADO

Colorado Springs.—The Colorado Bankers Association met here on September 14, and resolved that a committee of three be appointed by the president to attend the annual meeting of the American Bankers Association to be held at Chicago, September 23. This committee was to urge the American Bankers Association to recommend to the United States government the payment of a bonus on all gold produced during the present high cost of labor and supplies.

Also that the secretary of the Colorado Bankers Association was instructed to communicate to the Treasury Department at Washington the urgent necessity of immediate relief to the gold industry.

IDAHO

Elk City.—According to Francis A. Thomson, dean of the School of Mines at Moscow, in central Idaho the North-West possesses one of the greatest undeveloped potential gold-producing areas in America, but this great resource will remain locked until adequate means of access are available. During August he visited Buffalo Hump, Concord, Calander, Orogrande, Elk City, Dixie, Golden, and the Ten-Mile districts. In all of these the important typical and best developed properties were visited and studied. While systematic detailed sampling was impossible, representative



CENTRAL IDAHO, SHOWING GOLD DISTRICTS WORTH ATTENTION.

samples were taken at practically all properties sufficient to give at least a qualitative estimate of the value of the ore exposed. In addition, sampling data collected by other engineers, mill and smelter returns, etc., were made available for his inspection and reference. The gold deposits are of two types. The first includes the normal, typical, quartz veins, which are characteristic of large masses of granitic rock. These veins may be large or small, rich or poor, continuous or discontinuous. In central Idaho an astonishingly large number of them are mineralized, that is, they show pyrite or other sulphides commonly associated with gold, or where oxidized, the characteristic residues from these sulphides. These typical quartz veins occur both in the granite and in the gneiss. Nearly all of them are gold-bearing and the production of lode gold from this region has come almost entirely from this type of deposit. The second type, known locally as the dike deposits, are somewhat less common, and while not responsible for much of the lode gold so far produced maye prove eventually to be the more important. Nothing but placer mining or bonanza quartz mining can thrive under the present transportation and other conditions. The placers of central Idaho have been exhausted, and the cost of development has prevented all but the most surficial bonanzas being discovered. From these, $3,000,000 of lode gold has been produced. Throughout the whole region no workings were found deeper than 450 ft., and at this point the district has been marking time for 10 or 15 years. Furthermore, there is no reason to think that the district will not continue to mark time until some reasonable method of transportation is available, such as the proposed auto-road up the south fork of the Clearwater from Grangeville or Stites.

Wallace.—According to Robert N. Bell, State Inspector of Mines, resently returned from Butte and interviewed by the 'Miner,' the mine ventilating-system at that centre, one for circulating fresh air through intricate underground workings, is similar to that of the big coal mines in the East. It is especially adapted to Coeur d'Alene conditions. It consists essentially of smooth-lined main conduits, with plenty of blower capacity, plenty of electric motors, and plenty of substantial air-doors to direct its equal distribution underground and exhaust back to the surface. There are no natural rock temperatures in the Coeur d'Alene deep levels exceeding 80°, where workings have almost equaled those of Butte. Some local spots of higher temperatures than 80° are found here, but occur far above bottom levels and are doubtless largely due to slow local earth movement. A big improvement has been made in ventilating conditions at most of the big mines of this district in recent months. This includes the Morning mine at Mullan, where the company is now delivering over 200 cu. ft. of fresh air per minute per man employed to its deepest stoping level, No. 18, which is considerably in excess of the standard per man requirement of the Pennsylvanian coal-mine law.

KANSAS

Baxter.—Production of this district last week was 2167 tons of blende and 445 tons of lead, valued at $175,020.

MISSOURI

Joplin.—Production of the Tri-State region last week was 10,210 tons of blende, 436 tons of calamine, and 1940 tons of lead. The total value was $788,606. Missouri contributed $128,486. The total for 37 weeks is $18,209,479.

MONTANA

Butte.—Davis-Daly produced 705,093 lb. of copper and 31,922 oz. of silver in August; 4644 tons of ore was smelted. This is an increase of 80,000 lb. over July.

According to Robert N. Bell, State Inspector of Mines for Idaho, who recently visited Butte, with natural rock temperatures of 100° at the bottom of the deeper workings to contend with, ventilation and fire protection is one of the important economic problems that the Butte operators have to solve. These obstacles are being rapidly overcome, and a large expenditure is being made to this end by the Anaconda and other large companies through the medium of electric-driven Sirocco fans, concrete shafts and station lining, and the moving of power cables from shafts to parallel vertical diamond-drill holes. The Anaconda company is now delivering 1,500,000 cu. ft. of fresh air per minute to its extensive deep underground workings. There are in use 30 large Sirocco fans, varying in capacity up to 130,000 cu. ft. These are supplemented underground by 500 smaller machines. This company has given orders for more than $1,000,000 worth of new fans and motors of latest design to meet local conditions. In the design the company's mechanical department has effectively participated. It is evident from the great volumes of fresh air now being delivered at depths ranging down to 3600 ft. vertically and exhausted again through upcast shafts, that with the fuller completion of present plans and the proper utilization of the major installations, underground working conditions will rapidly improve, and the remarkably persistent orebodies of the Butte district, from a ventilating standpoint, may be followed to still greater depth.

Great Falls.—The new ferro-manganese plant of the Anaconda company was to start on September 17. A. E. Wiggin and E. S. Bardwell are in charge. One of the five furnaces is ready, while the remainder were expected to commence work on November 1. The total capacity is 90 tons per day. According to the Butte 'Miner', each furnace is 22 by 10 by 8 ft. inside measurement. Each has six electrodes, placed in pairs. Current is stepped down from 100,000 to 85 or 100 volts for use in the furnaces, the total consumption being 20,000 hp. A charge will consist of 500 lb. of manganese ore, 20 lb. of iron ore, 170 lb. of coal, and 70 lb. of limestone. Manganese from Butte is to be used. Eighty-five men will be employed.

NEVADA

Rochester.—The Rochester Mines Co. pays 2c. per share on October 1. This amounts to $45,000, and is the second of like amount paid this year.

OKLAHOMA

Picher.—Production of the districts last week was 5980 tons of blende and 1071 tons of lead, valued at $441,100.

OREGON

Baker.—Gold mines in Baker county are very short of men. This region produces 90% of the State's gold yield, and includes such properties as the Cornucopia, Powder River, and Rainbow.

UTAH

Alta.—The new aerial tram at the Sells mine is working. Its daily capacity is from 50 to 100 tons of lead-silver ore. More miners are wanted.

Bingham.—Utah Consolidated pays 25c. per share on September 30. This makes $1.25 for 1918, and $42.20 to date.

Park City.—The Judge M. & S. Co. pays 12½c. per share on October 1. This is equal to $60,000, making $2,250,000 to date.

Tintic.—On September 24 the Tintic Standard pays 8c. per share. This is equal to $94,000, making $105,723 for 1918, and $282,964 to date.

CANADA

British Columbia

Anyox.—Owners of the Salmon River and Bush gold mines, at the head of Portland canal, are busy constructing sleigh-roads. This will enable work to be continued in the winter. R. K. Neill of Spokane is in charge.

Sandon.—The Lucky Jim Mines Co. has issued a report covering a period of April 1914 to April 1918. The revenue was $228,161 from ore. The receivers, A. G. Larson, canceled debts amounting to $56,674.

Ontario

Cobalt.—Kerr Lake in August yielded 250,400 oz. of silver.

Nipissing produced 250,737 oz., a decrease of 54,000 oz. when compared with July, and 90,000 oz. less than in June. In August there was treated 98 tons of high and 6890 tons of low-grade ores.

Saskatchewan

The announcement that an immense deposit of potash has been discovered 30 miles north of Maple Creek, near Swift Current, Saskatchewan, has created much interest in British Columbia. Saskatchewan University men have recorded the claims and will retain their control. A branch railway is projected to connect the property with Maple Creek station.

KOREA

Unsan.—The Oriental Consolidated reports that the clean-up in July was worth $111,000. The June output was $143,320, from 25,289 tons of ore. In May, 24,017 tons yielded $134,551, of which $56,996 was profit. The Maibong mill was closed on July 3, the Maibong and Charabowie mines being worked out and abandoned.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

C. W. Purington is at Washington.

Victor Rakowsky is at Santa Barbara.

Robert A. Kinzie has returned from Ely, Nevada.

J. H. Mackenzie has returned from Washington on a short visit home.

T. S. Carnahan spent August in Idaho; he has returned to Bingham.

H. W. Young has returned to San Francisco from Colorado Springs.

D. M. Riordan is at Hanover, New Mexico, in the Santa Rita (or Chino) copper district.

William Fleet Robertson, Provincial Geologist of British Columbia, is on a visit to New York.

Charles S. Taylor is superintendent for the Atolia Mining Co., in San Bernardino county, California.

Louis Webb, until recently manager of the Lagrange mine in Trinity county, California, has gone to New York.

C. F. Kelley, the newly elected president of the Anaconda Copper Mining Co., was here for a few days last week.

Bruce C. Yates, superintendent for the Homestake company, has returned from a vacation in the Yellowstone National Park.

A. H. Rogers, of the firm of Rogers, Mayer & Ball, has recently returned to New York from British Columbia, Colorado, and Missouri.

George H. Hutton, superintendent for the Valdor Dredging Co., at Junction City, California, has resigned to enter the Engineer Corps of the Army.

A. H. Fay, mining engineer and statistician for the U. S. Bureau of Mines, spent two days at Lead, South Dakota, on his return from San Francisco.

R. W. Mackey, assistant foreman, and **L. M. McBride,** engineer to the Homestake company, have been recommended for commissions in the Engineering Corps.

Olaf P. Jenkins, assistant professor of economic geology in the State College of Washington, at Olympia, has been appointed geologist for the Arizona State Bureau of Mines, at Tucson.

Thomas Ewing, mining man and soldier of fortune, died in San Francisco on September 18, at the age of 83. Colonel Ewing was born at Lancaster, Ohio, in 1835. In 1859 he was one of a party to cross the plains to California. The Mother Lode knew him well as a contractor, prospector, and miner. The more difficult and dangerous the job, the better he liked it. He transported bullion from Grass Valley and Nevada City over the old stage-route across the Forest Hill divide. He could handle 20 mules with a jerk-line, a black-snake, and a vocabulary wonderful in its intensity, and scorching in its vitriolic punch. From there to the desert plains of Arizona, New Mexico, and California was his next move. He became an Army contractor and Indian fighter, serving under General Crook with food and supplies along trails infested with Apache Indians. Mining ventures in old Mexico, Arizona, Nevada, California, and Montana followed one another in rapid succession; the money he made in one he lost in the next; and an estate said to have run into the hundred of thousands went in an unfortunate real-estate venture near Seattle, where the collapse of a boom left Colonel Ewing stranded in the early 'nineties. With dauntless spirit so typical of the Westerner, and never sparing himself any physical hardship, he was constantly hatching one scheme after another, until he died of heart failure.

THE METAL MARKET

METAL PRICES

San Francisco, September 24

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	16
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	12
Zinc-dust, cents per pound	16

ORE PRICES

September 24

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$25

An international agreement for the pooling of all available tungsten among the United States and the Allies, reached through the Inter-Allied Munitions Council at Paris, was announced on September 19 by B. M. Baruch of the War Industries Board. Its terms will be made public if the arrangement is finally approved by President Wilson.

EASTERN METAL MARKET

(By wire from New York)

September 24.—Copper is unchanged, likewise lead. Spelter is quiet and easier.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date		Average week ending	
Sept.	18	Aug.	13
"	19	"	20
"	20	"	27
"	21	Sept.	3
"	22 Sunday	"	10
"	23	"	17
"	24	"	24

	26.00	26.00
	26.00	26.00
	26.00	26.00
	26.00	26.00
		26.00
	26.00	26.00
	26.00	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	....
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

Copper outputs of some of the large mines in August were as under:

Mine	Pounds	Mine	Pounds
Calumet & Hecla and 8 subsidiaries	10,718,520	Nevada Con	6,500,000
Chino	5,065,818	Old Dominion	2,064,000
Magma	900,000	Ray Con.	6,625,000
Mason Valley	1,245,000	Utah Copper	19,920,947
		Wolverine	334,547

C. & H., Chino, Old Dominion, and Ray reported decreases, while Utah was 3,900,000 lb. ahead of July.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

Date		New York,	London,	Average week ending		
Sept.	18	101.12	48.81	Aug.	13	99.62
"	19	101.12	48.81	"	20	100.25
"	20	101.12	48.81	"	27	101.12
"	21	101.12	48.81	Sept.	3	101.12
"	22 Sunday			"	10	101.12
"	23	101.12	48.81	"	17	101.12
"	24	101.12	48.81	"	24	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	....
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Silver export licenses granted by the Federal Reserve Board show that from September 1917 to May 24, 1918, metal worth $155,237,725 had been sent to the Orient; while from May 24 to August 23, 1918, licenses totaled $105,290,285. The Board says that applications for the exportation of silver were increasing, and that the amounts licensed for exportation would grow greater as the difficulty of obtaining gold or securing exchange at satisfactory rates increased.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date			Average week ending		
Sept.	18	9.85	Aug.	13	8.37
"	19	9.85	"	20	8.60
"	20	9.80	"	27	9.16
"	21	9.75	Sept.	3	9.42
"	22 Sunday		"	10	9.41
"	23	9.70	"	17	9.62
"	24	9.65	"	24	9.76

Zinc-ore prices were stronger at Joplin, Missouri, last week. Most of the second-grade concentrate (60% metal) sold at $52.50 per ton.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	....
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

Zinc-ore sales (60% metal) at Joplin last week were generally on a basis of $50 per ton.

LEAD

Lead is quoted in cents per pound, New York delivery. Government metal receives 7c. per lb. until August 6. Early in July producers agreed to fix prices at 8.05c. per lb., New York.

Date			Average week ending		
Sept.	18	8.05	Aug.	13	8.05
"	19	8.05	"	20	8.05
"	20	8.05	"	27	8.05
"	21	8.05	Sept.	3	8.05
"	22 Sunday		"	10	8.05
"	23	8.05	"	17	8.05
"	24	8.05	"	24	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	....
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

Lead ore (80% metal) is firm at $100 per ton at Joplin. Premium ore realizes $104.50.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date				
Aug.	27	120.00	Sept.	10
Sept.	3	120.00	"	17
			"	24

	120.00
	120.00
	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	....
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

Eastern Metal Market

New York, September 18.

The metal markets now under complete control and ruled by maximum prices, are copper, lead, and aluminum. All the markets are comparatively quiet, with a firm tone.

There are no changes in copper prices or fundamental conditions.

The tin market is a little stronger, but still inactive.

Lead is under complete control, and still extremely scarce.

Zinc is firm and strong, with sellers disinclined to offer. The tendency is upward.

Antimony is quiet and steady.

In the steel market there continues the cry for more steel, but there is little encouragement to the pleas for higher prices, though some makers of pig-iron and finished steel claim that in the last quarter their costs will be higher than present fixed prices. The August output of steel ingots is estimated at 3,498,000 tons for 27 working days, against 3,532,600 tons for 26 days in July, revealing a greater decline last month in the output of steel than of pig-iron. Interest centres in the meeting at Washington tomorrow, September 19, instead of today, between steel and iron makers and the War Industries Board regarding maximum prices effective after October 1.

A conference is being held in Washington today to consider the price of domestic manganese ore, which is to depend on the amount to be imported from Brazil. If these imports are to be reduced, higher prices for domestic ores and for ferro-manganese will be advocated.

COPPER

Labor conditions and the new draft seem to be the principal topics of discussion. That there is alarm as to the future output of copper, owing to the possible lack of labor or its inefficiency, is beyond doubt. It is understood that there will be a concerted effort by producers and refiners to have their employees listed in the deferred classes. There seem to be ample supplies of copper at present, but the future does not look so bright, and it is to guard against further reductions that efforts now are being directed. There has been a declining tendency in mine output, and also a surprising drop in refinery output in August. The hot weather may have accounted for some of this. There have been heavy decreases in copper imports in June, July, and August, but this is not regarded as serious, because the stocks of crude copper at refineries are ample. Sales and distribution of the metal continue under the control of the Copper Producers' Committee, which seems to be giving satisfaction under difficult conditions. The price of 26c. per lb. is to continue until November 1, with that for less than 5-ton lots at 27.35c. per pound.

TIN

Brief allusion was made in last week's letter to the unconfirmed report that an Allied Executive Tin Committee had been formed to sit in London, composed of representatives of several nations, and that it would control the purchases and distribution of tin for the Allies. Late last week what is understood to have been an official confirmation of this was given out at Washington. Aside from this nothing definite is known here. Importers and dealers are completely at sea as to what has been done or as to what is to happen. They do not know whether their business has been done away with or not. Either such parties in this country will continue to act as a go-between in all transactions subject to the new control, or there will be no use for them at all. The situation is unsatisfactory in its complete uncertainty. There is an impression that too much secrecy is being practised for the good of the market. The market in the past week has been a little more active. Considerable inquiry has developed in the last few days for delivery this year, but it was met by few sellers. This was owing to the lack of tin, and not to any lack of desire to sell. But little business was done. A decided absence of interest is noted in the future-shipment market, but offerings here also have been few. Spot tin is now quoted nominal at 78.50c., New York, with little offering. This price is slightly higher than the low mark of the week at 77c. on September 11. Arrivals of tin at Pacific ports so far this month have been reported as 1320 tons, with 1315 tons arrived at Atlantic ports. The London market has undergone little change, the quotation for spot Straits having been £344 per ton yesterday, against £343 10s. a week ago.

LEAD

The War Industries Board has asked the Lead Producers' Committee to take upon itself officially the entire management of the lead industry, analagous to the duties of the Copper Producers' Committee. The principal difference exists in the fact that the Lead Committee is to attend to all sales, the producers having put their supplies at the disposal of this committee for sale. The situation otherwise is unchanged, with lead as scarce as ever. There is anxiety as to the labor supply to keep production to the maximum, and it is hoped that the new draft will not seriously interfere with this industry. Prices are held by agreement at 7.75c., St. Louis, or 8.05c., New York, with less than carload lots at 8.55c. per lb. When less than one ton is involved, the price may be no more than 8.80c. per lb., New York, or 0.75c. over the base price. Retail dealers are to be strictly held to these rules.

ZINC

The firmness noted last week continues with prices nominally higher. There is not much inquiry from sources outside of the Government itself, and the market is inactive. Producers are well sold up for September and October, and are content to offer little if any metal. There appears to be a distinct scarcity of prompt and September prime Western zinc, for which the quotation is firm at 9.50c., St. Louis. The freight rate now being 35c. per lb. from St. Louis to New York, quotations based at New York should read 35 points above the St. Louis base price. The New York quotation is therefore now 9.85c. for September-October delivery. For last quarter the quotation is firm at 9.20c., St. Louis, or 9.55c., New York. The 6000 tons of grade D, noted last week as wanted by the Government, is said to have been contracted for; it is for delivery in the last quarter at about 2000 tons per month. Bids are understood to have been asked for today for 1000 tons of Navy C zinc. The weekly Government report of the zinc industry shows the output to have decreased 169 tons and the stocks of all grades to have increased 2591 tons, that in grade D, 1037 tons, having been the largest.

ANTIMONY

The market is quiet at 13.87½ to 14c., New York, duty paid for prompt and early delivery, with demand very light.

ALUMINUM

Government maximum prices control the market for No. 1 virgin metal, 98 to 99% pure, and for scrap at 33c. per lb. for 50-ton lots, at 33.10c. per lb. for 15 to 50-ton lots and at 33.20c. per lb. for 1 to 15-ton lots.

Dividends From Mines, United States and Canada

UNITED STATES

Company and situation	Metal	Shares issued	Par value	Paid in 1918	Total	Latest dividends Date	Amount
Ahmeek, Michigan	copper	200,000	$25.00	1,600,000	10,050,000	Sept. 27, 1918	$2.00
Allouez, Michigan	copper	100,000	25.00	600,000	.....	Sept. 1918	1.50
American S. & R., U. S. and Mex.	c.l.z.s.g.	650,000 500,000 7% pfd.	100.00	.....	.....	Sept. 16, 1918 Sept. 3, 1918	1.50 1.75
American Z. L. & S., United States	c.l.z.s.g.	96,560	25.00	144,840	.....	May 1, 1918	1.50
Anaconda, Montana	c.z.s.g.	2,331,250	50.00	9,325,000	147,032,500	Aug. 26, 1918	2.00
Atolia, California	tungsten	100,000	1.00	600,000	.....	Sept. 15, 1918	0.50
Arizona, Arizona	copper	1,519,896 £316,530 7% pfd.	1.20	112,000 1,186,000	2,190,000 21,168,000	Mch. 31, 1918 Aug. 21, 1918	... 0.36
Arizona Commercial, Arizona	c.g.s.	175,000	5.00	.....	525,000	July 31, 1918	0.50
Barnes-King, Montana	gold	400,000	5.00	120,000	220,000	Aug. 15, 1918	0.10
Bingham Mines, Utah	l.s.g.	150,000	10.00	213,000	463,250	Oct. 1, 1918	0.50
Bunker Hill & Sullivan, Idaho	l.s.	327,000	10.00	.....	20,860,500	.....	...
Butte Copper & Zinc, Montana	c.z.mn.	411,700	5.00	205,800	205,800	July 30, 1918	0.50
Caledonia, Idaho	l.s.	2,605,000	1.00	312,500	3,454,650	July 17, 1918	0.03
Calumet & Arizona, Arizona	copper	642,462	10.00	3,854,772	39,847,734	Sept. 23, 1918	2.00
Calumet & Hecla, Michigan	copper	100,000	25.00	4,000,000	149,250,000	Sept. 20, 1918	15.00
Center Creek, Missouri	z.l.	100,000	10.00	10,000	660,000	April 1, 1918	0.05
Champion, Michigan	copper	100,000	25.00	1,280,000	22,634,541	Aug. 15, 1819	6.40
Chief Con., Utah	l.z.s.g.c.	884,223	1.00	287,370	1,124,341	Aug. 3, 1918	0.02½
Chino, New Mexico	copper	869,980	5.00	3,044,930	24,228,092	Sept. 25, 1918	1.00
Cerro Gordo, California	l.z.s.	975,000	1.00	.....	175,000	Oct. 15, 1917	0.05
Copper Range, Michigan	copper	394,399	25.00	1,774,796	24,237,417	Sept. 14, 1918	1.50
Con. Interstate-Callahan, Idaho	z.l.s.	464,990	10.00	464,990	6,742,355	June 15, 1918	0.50
Continental Zinc, Missouri	z.l.	22,000	5.00	11,000	396,000	Jan. 2, 1918	0.50
Con. Arizona, Arizona	c.s.g.	1,663,000	5.00	415,750	748,350	Sept. 14, 1918	0.05
Cresson, Colorado	gold	1,220,000	1.00	1,098,000	6,783,162	Sept. 10, 1918	0.10
Daly, Utah	l.s.g.	150,000	20.00	45,000	3,030,000	Oct. 1, 1918	0.10
Davis-Daly, Montana	copper	600,000	10.00	300,000	300,000	June 29, 1918	0.50
Dragon Con., Utah	c.l.s.g.	1,875,000	1.00	56,750	131,250	July 25, 1918	0.01
Ducktown, Tennessee	copper	198,000	4.80	.....	2,678,702	May, 1917	0.96
Eagle & Blue Bell, Utah	l.c.z.s	893,146	1.00	267,945	1,162,461	Sept. 20, 1918	0.10
East Butte, Montana	copper	411,000	10.00	.....	411,000	Dec. 29, 1917	1.00
Electric Point, Washington	lead	793,500	1.00	47,580	214,110	Aug. 31, 1918	0.03
Elko Prince, Nevada	gold	1,108,566	1.00	110,856	166,284	April, 1918	0.05
Empire, Idaho	copper	1,000,000	1.00	100,000	880,000	July 1, 1918	0.05
Engels, California	copper	1,791,926	1.00	216,824	645,529	Sept. 1, 1918	0.01½
Federal, Idaho	l.z.s.	120,000	100.00	629,271	14,555,723	Sept 15, 1918	1.75
First National, California	copper	600,000	5.00	90,000	570,000	Aug. 1918	0.15
General Development, U. S.	.....	120,000	25.00	330,000	4,913,917	Sept. 3, 1918	1.00
Golden Cycle, Colorado	gold	1,500,000	1.00	135,000	8,313,500	Mch. 10, 1918	0.03
Grand Central, Utah	l.s.	500,000	1.00	25,000	1,759,750	April 12, 1918	0.05
Hecla, Idaho	l.s.	1,000,000	0.25	200,000	7,105,000	Sept. 28, 1918	0.15
Homestake, South Dakota	gold	251,160	100.00	1,130,220	41,250,000	Sept. 26, 1918	0.50
Inspiration, Arizona	copper	1,181,967	20.00	4,727,868	20,663,213	July 29, 1918	2.00
Iron Blossom, Utah	l.s.g.	1,000,000	0.10	50,000	3,150,000	July 25, 1918	0.02½
Iron Cap, Arizona	copper	144,872	10.00	325,938	670,415	Sept. 2, 1918	0.25
Isle Royale, Michigan	copper	150,000	25.00	75,000	.....	Sept. 27, 1918	0.50
Jim Butler, Nevada	s.g.	1,718,021	1.00	311,802	1,170,813	July, 1918	0.07
Judge, Utah	l.z.c.s.g.	480,000	1.00	180,000	2,250,000	Oct. 1, 1918	0.12½
Kennecott, Alaska	copper	2,786,679	5.00	8,360,037	.....	Sept. 20, 1918	1.00
Magma, Arizona	copper	240,000	5.00	360,000	1,664,000	Sept. 30, 1918	0.50
Mary Murphy, Colorado	g.s.l.z.	370,000	5.00	.....	93,106	April, 1916	0.07
Mass Con., Michigan	copper	100,000	25.00	.....	500,000	Aug. 15, 1917	1.00
Miami, Arizona	copper	747,114	5.00	2,614,899	18,847,930	Aug. 15, 1918	1.00
Mohawk, Michigan	copper	100,000	25.00	800,000	.....	July 1, 1918	2.00
Nevada Con., Nevada	copper	1,999,457	5.00	5,008,641	41,780,163	Sept. 25, 1918	0.75
Nevada Packard, Nevada	silver	1,164,592	1.00	29,117	87,351	Sept. 2, 1918	0.02½
New Idria, California	quicksilver	100,000	5.00	150,000	2,680,000	Oct. 1, 1918	0.50
New Jersey Zinc, New Jersey	zinc	350,000	100.00	.....	.....	June 10, 1918	4.00
North Butte, Montana	c.s.g.	430,000	15.00	322,500	14,559,500	July 29, 1918	0.25
North Star, California	gold	250,000	10.00	50,000	5,387,040	Mch. 29, 1918	0.20
Old Dominion, Arizona	c.s.g.	293,353	25.00	880,059	13,774,244	Sept. 30, 1918	1.00
Ontario, Utah	s.l.	150,000	100.00	.....	15,112,000	Oct. 5, 1918	0.50
Osceola, Michigan	copper	96,150	25.00	769,200	17,179,475	Sept. 27, 1918	2.00
Phelps-Dodge, Ariz., N. Mex., Mex.	c.s.g.	450,000	100.00	9,900,000	76,496,527	Sept. 30, 1918	8.00
Plymouth Con., California	gold	240,000	4.80	57,600	518,400	Jan. 31, 1918	0.24
Portland, Colorado	gold	3,000,000	1.00	240,000	11,197,600	July 25, 1918	0.02
Prince Con., Nevada	l.s.	1,000,000	2.00	.....	575,000	Nov. 1, 1917	0.02½
Quincy, Michigan	copper	110,000	25.00	715,000	26,232,500	Sept. 30, 1918	2.00
Ray Con., Arizona	copper	1,577,179	10.00	3,942,945	19,981,197	Sept. 25, 1918	0.75
Rochester Mines, Nevada	s.g.	2,148,791	1.00	89,930	89,930	Oct. 1, 1918	0.02
Shannon, Arizona	copper	300,000	10.00	.....	1,425,000	Nov. 15, 1917	0.25
Shattuck, Arizona	c.l.s.g.	350,000	10.00	700,000	7,087,500	Oct. 19, 1918	0.50
Silver King Con., Utah	l.s.c.g.	700,000	1.00	70,000	1,562,705	April 1, 1918	0.10
St. Joe Lead, Missouri	lead	1,464,780	10.00	1,464,780	12,000,000	June 20, 1918	0.50
Tamarack & Custer, Idaho	l.s.	1,776,500	1.00	213,148	.....	Aug. 27, 1918	0.06
Tennessee Copper, Tennessee	copper and acid	391,498	no par value	391,498	.....	May 15, 1918	1.00
Tintic Standard, Utah	l.s.	1,175,000	0.10	199,723	282,964	 1918	0.08
Tomboy, Colorado	g.s.	310,000	4.80	37,200	4,074,200	June 28, 1918	0.12
Tonopah Belmont, Nevada	s.g.	1,500,000	1.00	337,500	9,480,559	July 1, 1918	0.10
Tonopah Extension, Nevada	s.g.	1,282,801	1.00	.....	1,912,399	April 2, 1917	0.10
Tonopah Mining, Nevada	s.g.	1,000,000	1.00	300,000	14,875,000	Oct. 21, 1918	0.15
United Copper, Washington	copper	1,000,000	1.00	.....	150,000	Oct. 15, 1917	0.01
United Eastern, Arizona	gold	1,363,000	1.00	613,350	1,022,450	Sept. 26, 1918	0.05

Company and situation	Metal	Shares issued	Par value	Paid in 1918	Total	Latest dividends Date	Amount
U. S. S. R. & M., U. S., Mexico	l.z.c.s.g.	pfd. 486,350 com. 351,115	50.00 50.00	1,702,224 1,755,576	21,476,817 11,190,175	July 15, 1918 July 15, 1918	0.87½ 1.25
United Verde Copper, Arizona	copper	300,000	no par value	5,100,000	51,047,000	July 18, 1918	1.50
United Verde Extension, Arizona	copper	1,050,000	0.50	2,362,500	.....	Nov. 13, 1918	0.75
Union Con., Nevada	s.g.	200,000	1.00	80,000	.....	July 1918	0.05
Utah Apex, Utah	c.l.s.g.	528,200	5.00	132,050	990,375	Aug. 10, 1918	0.25
Utah Con., Utah	c.l.s.g.	300,000	5.00	375,000	12,660,000	Sept. 30, 1918	0.25
Utah Copper, Utah	copper	1,624,490	10.00	12,184,075	87,954,958	Sept. 25, 1918	2.50
Utah Metal, Utah	l.c.g.s.	691,588	1.00	.....	895,734	Dec. 10, 1917	0.30
Vindicator Con., Colorado	gold	1,500,000	1.00	45,000	3,757,500	July 1918	0.03
Wellington Mines, Colorado	l.z.	1,000,000	1.00	100,000	1,750,000	Jan. 1, 1918	0.10
West End, Nevada	s.g.	1,788,486	5.00	357,698	1,073,092	Oct. 16, 1918	0.10
Wolverine, Michigan	copper	60,000	25.00	240,000	10,130,000	Oct. 1, 1918	1.00
Yellow Aster, California	gold	1,064,310	1.00	35,000	1,245,789	July 20, 1917	0.05
Yellow Pine, Nevada	z.l.	1,000,000	1.00	120,000	2,130,000	June 15, 1918	0.06
Yukon Gold, Alaska, Cal., Nev.	gold	3,500,000	5.00	87,500	.....	Mch. 30, 1918	0.02½
CANADA							
Buffalo, Ontario	silver	1,000,000	1.00	250,000	3,287,000	Aug. 10, 1918	0.25
Coniagas, Ontario	silver	800,000	5.00	300,000	9,040,000	Aug. 1, 1918	0.02½
Con. M. & S., British Columbia	l.c.z.s.g.	419,098	25.00	1,047,741	4,994,104	Oct. 1, 1918	0.62½
Granby Con. M. S. & P. B. C.	c.g.s.	150,004	100.00	1,499,848	10,573,857	Nov. 1, 1918	2.50
Hedley, British Columbia	gold	120,000	10.00	72,000	2,394,000	Sept. 30, 1918	0.15
Hollinger, Ontario	gold	4,920,000	5.00	492,000	8,526,000	Aug. 12, 1918	0.05
Howe Sound, British Columbia	copper	1,984,150	1.00	99,207	99,207	April 15, 1918	0.05
International Nickel, Ontario	n.c. com.	1,673,384	25.00	3,346,768	.....	June 1, 1918	1.00
Kerr Lake, Ontario	silver	600,000	5.00	450,000	7,860,000	Sept. 16, 1918	0.25
McKinley-Darragh, Ontario	silver	2,247,692	1.00	269,724	5,349,607	Oct. 1, 1918	0.03
McIntyre, Ontario	gold	3,610,283	1.00	361,028	900,570	June 15, 1918	0.05
Mining Corp., Ontario	silver	1,660,050	5.00	1,141,285	5,594,838	Sept. 16, 1918	0.18¾
Nipissing, Ontario	silver	1,200,000	5.00	1,200,000	18,630,000	Oct. 21, 1918	0.50
Standard, British Columbia	l.z.s.	2,000,000	1.00	.....	2,700,000	Oct. 15, 1917	0.05
Temiskaming, Ontario	silver	2,500,000	1.00	75,000	2,125,000	Jan. 18, 1918	0.03
Tough-Oakes, Ontario	gold	531,500	5.00	.....	398,625	Jan. 15, 1917	0.12½

Abbreviations: g = gold, s = silver, c = copper, l = lead, z = zinc.

Note: Companies not included in the above list are requested to submit details. Changes in capitalization and new dividends will be entered on receipt of the information. This table will be published quarterly.

Production of Zinc Ore

The following table, prepared by C. E. Siebenthal, of the U. S. Geological Survey, shows the sources and output of zinc ore during 1917:

Compared with 1916, last year shows a gain of 8777 tons of recoverable zinc, equal to 1.3%. Decreases of 58,000 tons in Missouri, Montana, Colorado, and Nevada, were offset by an increase of 57,081 tons in Oklahoma.

Arkansas did not keep up its expected output, but only dropped 124 tons. California fell off 2192 tons, Idaho 3326 tons, and Utah 4143 tons. Kansas gained 7801 tons. New Jersey (the New Jersey Zinc Co.) increased from 110,698 to 119,731 tons, equal to 8%. Tennessee continues to enlarge its production, the 28,498 tons being 2070 tons better than in 1916.

Districts producing more than 1000 short tons of recoverable zinc in 1917. (Subject to revision).

District	State	Crude zinc-bearing ore sold or treated	Shipping ore and concentrates: Total quantity	Sulphides: Quantity	Sulphides: Recoverable zinc content	Carbonates and silicates: Quantity	Carbonates and silicates: Recoverable zinc content	Total recoverable zinc content	Percentage of total production
Joplin	Mo.	3,447,850	262,095	231,404	121,722	30,693	10,988	132,730	18.7
	Kans.	903,400	38,787	38,766	20,242	21	7	20,249	2.8
	Okla.	3,523,200	159,780	159,656	85,744	124	45	85,789	12.1
Total		7,874,450	460,662	429,824	227,728	30,838	11,040	238,768	33.6
Franklin Furnace	N. J.	720,561	609,005	-------	-------	609,005	119,736	119,736	16.9
Butte	Mont.	892,362	284,570	284,570	90,145	-------	-------	90,145	12.8
Upper Mississippi Valley	Wis.	3,014,800	226,216	223,916	59,190	2,300	552	59,742	8.4
	Ill.	327,340	18,221	18,221	267	-------	-------	4,267	0.6
	Iowa	600	60	-------	-------	60	18	18	----
Total		3,342,740	244,497	242,137	63,457	2,360	570	64,027	9.0
Coeur d'Alene	Ida.	1,126,816	113,830	113,830	38,875	-------	-------	38,875	5.5
Leadville	Colo.	228,003	228,003	158,923	19,683	69,090	10,653	30,336	4.3
East Tennessee	Tenn.	939,052	67,108	35,703	18,202	31,405	10,296	28,498	4.0
Other Colorado	Colo.	192,450	76,894	78,894	24,503	-------	-------	24,503	3.4
New Mexico	N. M.	140,821	61,522	61,522	15,471	-------	-------	15,471	2.2
Yellow Pine	Nev.	38,641	34,372	-------	-------	34,272	10,263	10,263	1.4
Wallapai (Union Basin)	Ariz.	101,796	25,309	25,309	8,564	-------	-------	8,564	1.2
Northern Arkansas	Ark.	203,600	17,969	916	482	17,053	6,209	6,691	0.9
Edwards	N. Y.	47,961	12,466	12,466	5,192	-------	-------	5,192	0.6
Bingham	Utah	240,017	16,955	16,955	4,402	-------	-------	4,402	0.4
Shasta	Cal.	167,146	11,250	11,250	3,160	-------	-------	3,160	0.4
Park City	Utah	133,231	8,211	8,211	2,601	-------	-------	2,601	0.4
San Francisco	Utah	47,883	4,970	4,970	1,769	-------	-------	1,769	0.2
Southern Virginia	Va.	44,000	9,700	2,841	761	6,859	942	1,703	0.2
Cerro Gordo	Cal.	6,400	6,400	-------	-------	6,400	1,685	1,685	0.2
Total		16,487,930	2,293,693	1,486,321	524,995	807,372	171,394	696,389	97.9
All other districts								14,583	2.1
Total for United States								710,972	

INFORMATION FURNISHED BY MANUFACTURERS

JACKSON ROTARY COMPRESSORS

For several years past, H. O. Jackson, founder of the Jackson Compressor Co., with a staff of engineers has been developing and perfecting a type of compressor for which numerous features are claimed making for a simpler and more efficient compressor-performance. The Jackson rotary compressor, which is a patented device, by reason of its rotary feature, makes a saving of 75% in weight and in floor-space over other designs of compressor and effects a reduction in power. One of the features of the Jackson is that it is without valves, and hence it is devoid of all valve-trouble. The oiling-system is of the circulating type, which

JACKSON ROTARY AIR-COMPRESSOR

ensures ample lubrication with a minimum loss of oil. There is one oil-tank and one valve that controls the feed of the oil into both the compressor and bearings. All of the compressor bearings are of the best grade ball and Hyatt-roller design. The simplicity of construction is one of the outstanding features of the design, there being only five moving parts necessary to compress the air and about the same number of parts in the cylinder and base. The rotary motion, with its well-balanced even torque, makes for a high driving-efficiency, with practically no transmission-loss in power. The light weight makes heavy cumbersome foundations unnecessary. The machine is absolutely noiseless, and the power-requirement has been materially reduced. Jackson rotary compressors are built in sizes to meet the requirements of mine and mill-operation. They are adapted to either belt or direct drive and are also made as direct-connected gasoline-engine compressor-units. All machines are thoroughly tested before leaving the factory, and are guaranteed for one year against defects in material and workmanship. The new plant of the Jackson Compressor Co., the first unit of which is complete and in operation, is of the most improved type of construction. This first building, which is 122 by 225 ft., is fitted with underground concrete conduits for wiring to the various machines, all of which have an individual drive. The power-plant has automatic stoking and coal-handling equipment. Every detail has been designed for efficiency in manufacture and comfortable working conditions for employees. When the plant is completed it will cover the block bounded by Cherokee street, Alameda avenue, Cedar avenue, and the Santa Fe tracks, Denver, Colorado.

COMMERCIAL PARAGRAPHS

The Pocahontas Manganese Corporation, operating properties at Graham, Virginia, has increased its capital from $25,000 to $100,000 for extensions to plant.

The Michigan Smelting & Refining Co., Hamtramck, Michigan, has had plans prepared for the erection of a new works on Joseph Campau avenue, to cost about $100,000.

The Balbach Smelting & Refining Co., Newark, New Jersey, has filed plans for the construction of a new reverberatory furnace at its works, Avenue R and Doremus avenue.

To add to its present holdings in the vicinity of its works at Franklin, New Jersey, the **New Jersey Zinc Co.,** of New York, has purchased Lake Wawayanda and surrounding districts.

The Air Nitrates Corporation, 360 Madison avenue, New York, will build a new addition to its Elizabethtown, Ohio, works, to cost about $25,000. The plant will be used for the production of materials for the Government.

C. W. Cross has been appointed representative for the sale of the products of the **Chicago Pneumatic Tool Co.** to the railroads, in place of L. C. Sprague, who has been promoted to be district manager of sales at New York.

The Sloss-Sheffield Steel & Iron Co., Birmingham, Alabama, will construct a new battery of coke ovens, of Semet-Solvay type, to cost, with by-product equipment, about $5,000,000. The new plant will consist of a series of 120 coke ovens, with output to be used at the local furnaces of the company. It is planned to have the works ready for operation within 12 months. J. W. McQueen is president.

The Detroit Graphite Co., makers of paint and color, has opened a sales office in Salt Lake City at 406-407 Boston building. P. D. Whatley is in charge of the Salt Lake City office and takes care of the need of our customers in Utah, Montana, and Colorado. Mr. Whatley has been with the Detroit Graphite Co. for many years. He has had long training at the factory and in the field, and is in a position to intelligently discuss paint-requirements for the various surfaces and service-conditions in mining and other departments of industry. This company is also represented in the South-West by George S. Thomson, the well-known manufacturers' representative, with office and warehouse at 104 Leon street, El Paso. Mr. Thomson travels through southern California, Arizona, New Mexico, and Mexico. He is intimately acquainted with the mining trade and its paint requirements. He maintains a warehouse-stock of paint at El Paso for immediate deliveries. The Detroit Graphite Co. manufactures paints for all purposes. Its metal-protective coating, 'Superior Graphite Paint,' is well and favorably known in the West and South-West.

Mining and Scientific Press

Edited by T. A. RICKARD

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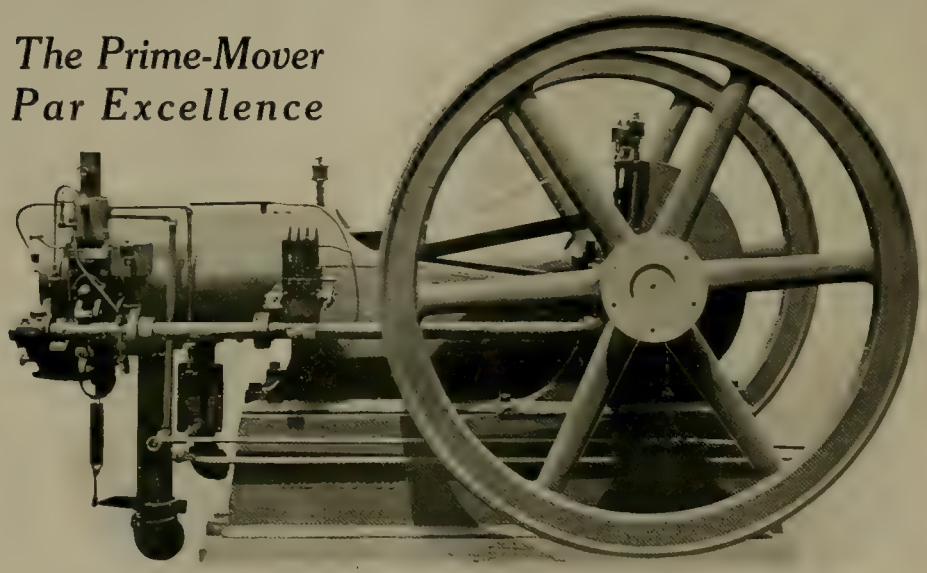

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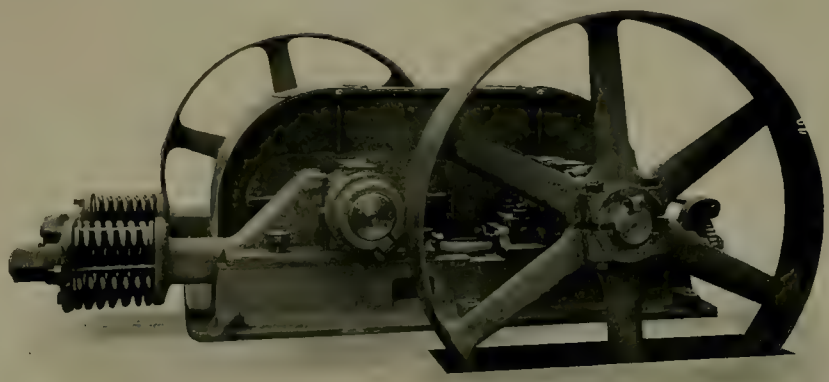

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E. H. LESLIE, 600 *Fisher Bdg., Chicago*
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EDITORIAL

ALL'S WELL on the Potomac, and on the Vardar, also the Jordan, the Dvina, the Meuse, the Suippe, the Ailette, and the Yser. In these days a knowledge of geography gives zest to life.

HUMOR is not lacking in the German reports of military events. "The enemy followed hesitatingly," says Ludendorff. "The English followed us only step by step," says Leman von Sanders. "We are advancing to prepared positions in our rear," says Von Stein. To which we may add that, according to our non-military observation, it seems clear that the Germans are advancing vigorously from the south to the north, and their friends in Bulgaria and Palestine are doing their best to imitate their example.

NO pact is possible with an outlaw; that is the essence of the President's dictum. We cannot come to terms with governments that are without honor. The men that called the Belgian treaty "a scrap of paper" are unrepentant, for did they not lure the poor Russians into a treaty at Brest Litovsk and the Rumanians at Bucharest, and then with cynical effrontery break every obligation into which they had entered, using brute force in complete disregard of their own promises! "No peace by compromise," says the President; we must see this thing through to the end, else we break faith with the dead.

THE demand for cash to balance the outlay required for maintaining our Army in France has not been in evidence because the transactions have consisted in entries on the credit side of the ledger-account with our gallant Ally. The realities of the disbursement and its influence on foreign exchange, however, now begin to appear, when, for the first time in its history, the weekly balance-sheet of the Bank of France carries the name of the United States as a depositor to the extent of $200,000,000. This is the beginning of the visible movement of our money abroad, introducing the novel feature into our foreign relations of the transference of a cash balance for account of Freedom instead of Trade.

PULVERIZED limestone has assumed increasing importance within the last few years as a dressing for acid soils. It adds greatly to the productiveness of the land, and its use has done much toward augmenting the food-supply at this critical moment. Many grinding-plants have been established, and the demand for the product was growing so rapidly as to warrant the erection of additional mills, but development was halted by the impossibility of securing equipment and favorable transportation privileges. These difficulties have now been removed by the action of the War Priorities Board in placing agricultural lime, both raw and burned, in the preferred classification, which includes machinery, fuel, and transportation service. This opens a larger market for crushing and grinding-appliances.

LEST we forget, let us recall the malicious beastliness of the German devastation of French homes, as reported now by our own soldiers: how, for instance, at Chateau Thierry they destroyed the surgical instruments in a doctor's house and defiled the children's toys in other houses. We might overlook the wanton spoiling of works of art and the smashing of furniture, as only more evidence of the barbarian, but we shall not forgive the Huns for their filthy practices and their vicious desecration of all that is beautiful and beneficent. It is reported that two or three houses at Chateau Thierry are to be kept just as they were left by the retreating Germans, as an exhibit of Kultur. It is well; the world must not soon forget what it so barely escaped; the domination of the beast with the brain of an engineer.

ACCORDING to Major George F. Sever, representing the War Industries Board at a joint meeting of engineering societies in San Francisco on September 26, the allocation of power is distributed under three headings: war industries, war essentials, and public utilities. Mining is placed far down in the third class. It is worthy of note that moving pictures and the making of ice-cream are ahead of gold mining. In answer to a question, Major Sever stated that it was just as well to leave the gold in the ground. Mr. H. G. Butler, the so-called Power Administrator, could not explain why electricity was furnished for the benefit of cinemas, saloons, and the pleasure resorts of San Franciscan night-life in preference to the mines of the Mother Lode. The Government has asked employers to recruit labor only through the Labor Bureau, but when the superintendent of the Central Eureka mine, for example, asked for miners and

carmen, he was advised that no assistance could be given and that his order was cancelled. The evident effort to please the voters at the expense of important industry warrants the resentment of those engaged in mining.

THE Transvaal produced 740,210 fine ounces of gold in August, this being 16,418 ounces less than the returns for the same month in 1917. The total output for the first eight months ended August 31 has been 5,732,743 fine ounces, representing a decline of 5.82% from the production in the same period last year, and only 3.77% from the output of 1915. The distance from the great depots of supplies, necessitating the maintenance of large stocks in warehouse, together with the fact that the productive area is a single unit, so that nearly identical conditions govern the whole district, go far toward explaining the relatively small proportion of the decline in the South African in contrast with the rapid decline in the American output. The production in the United States for 1917 was approximately $84,500,000, and for 1915 it was $101,035,700, showing a decrease of 16.33%. This reveals the effect of severe competition in the market for supplies and labor, and the lack of a protective stock of steel and other necessaries to tide over a period of stress. If the War continues another year the exhaustion of stocks and depletion of labor will greatly reduce the output of gold in South Africa, despite the advantage of a large local production of explosives at moderate prices.

IN an English paper we read of the chagrin with which a hundred men employed at a Cornish mine received an unexpected demand for income-tax. Undoubtedly there are thousands of miners in this country that are receiving pay sufficiently large to bring them within the cognizance of the tax-collector, and it is only fair that they should contribute their proper share to the national exchequer during this time of war. It is estimated that nine-tenths of the personal income-taxes collected on account of 1916 came from incomes of more than $25,000 and that labor paid less than one-tenth of 1%—which reminds one of the supposititious critical proportion of oil in the flotation process. Even those having incomes of $5000 and less contributed less than 2% of the grand total of $173,000,000 collected for that year. Evidently capital is bearing a large part of the financial burden that has been laid upon the country, as it should, but it is equally evident that labor should bear its proportion. Those hardest hit are the professional classes and others receiving a nearly fixed income, on whom the abnormal cost of living is falling without alleviation from higher wages or bigger dividends. However, it is this class that is the most intelligent and therefore appreciates best the greatness of the cause for which the whole body of citizens is called upon to make sacrifices, of which taxation is one of the least, for, after all, a man that has to pay a big income-tax is lucky to have the income on which to pay it. Moreover, he has the privilege and opportunity of buying Liberty Bonds—the finest investment that was ever offered.

Bankers Endorse the Gold Propaganda

Now that the American Bankers' Association has requested that the Government take immediate action to maintain the production of gold at its normal pre-war volume, as appears in the resolutions printed elsewhere in this issue, one obstacle that had threatened to impede legislation for relief of the industry has been removed. Amid the overwhelming routine of the enormous business that the commerce of war has entailed, the bankers of the East have scarcely realized the decline in gold production. The statement of the fact in the financial papers could produce but a feeble mental impression compared with the Treasury reports showing our stock of gold rising above the three billion dollar mark and embracing nearly half of all in the possession of mankind outside the people of India and China. Therefore, no interest in the plight of the gold producers had been awakened, nor had the significance of their contribution to the financial strength of the country been appreciated. The bankers, in short, had not thought seriously about the matter; they were either indifferent or disposed to suspect the gold miners of having an eye to undue profits when begging the Government to save them from ruin. Accordingly it is proof that convincing argument was used to persuade the 4000 representative bankers in convention at Chicago to endorse the position taken by the gold producers at recent conferences. The bankers have gone a step further in their declaration that "considering the great importance of this subject this Convention recommends to the Executive Council that the matter be referred to the Federal Legislative Committee and the Currency Commission for exhaustive study, and for such action as may be deemed necessary." Thus it appears that the American Bankers' Association did more than pass perfunctory resolutions, that, in fact, it made the gold propaganda a part of the order of business for its permanent Executive Council. Here is an ally indeed for the gold miner. Economists and financiers among the bankers have not been slow to comprehend the danger that lay in a general decline of the gold industry. The bankers of the Pacific Coast had already taken the initiative at their Gold Conference on September 5. The full report of the proceedings at Chicago has not yet reached us, but we know that Mr. Eugene Davis of Reno, and Messrs. A. L. Mills and E. G. Crawford of Portland, and Mr. John Clausen of San Francisco constituted an effective group in pleading for sustained gold production before the American Bankers' Association. The proceedings at Chicago are symptomatic of what may be achieved at Washington if the case be urged there promptly and energetically. We fear that the gold miners have been somewhat discouraged; efforts have been made to dash their enthusiasm by accounts of objectors to the principle of a bounty, of powerful opponents, and of indifference in the East. These should serve only to arouse our friends to a more determined fight. With the bankers on their side they should start at once upon an intensive campaign at Washington. Delay will make the achieve-

ment more difficult. It is the financiers whose word will determine what relief, if any, shall be given to the producers of gold, and the time to strike is before these men settle back into indifference to the crisis. The spirit of that meeting is in danger of being stifled by the spread of the new financial doctrine that minimizes the importance of gold. This doctrine involves a subtle fallacy, perilous to our financial stability; its influence colors a recent statement by a distinguished governor of a Federal Reserve Bank in which he says, "We have come to understand that the supply of gold is not for the purpose of liquidating bank credits. The former never was nor could it be adequate for that purpose. It is the best measure of value ever discovered and is intended for that purpose, and its chief use is as a guarantee of the soundness of currency based upon it. I am not prepared to say what, in my opinion, if anything, should be done in the way of a subsidy to gold producers, or whether this situation should be left to cure itself, or whether it will cure itself if left to itself. This one thing, however, is certain, we have learned how to make the supply go infinitely further than in former times, and have learned that it is neither necessary nor desirable to use gold itself as currency, but rather as a basis to test the soundness of currency." As a corollary to this we may cite Mr. Irving Fisher, the distinguished economist, who bases his opposition to extending aid to the gold industry on the familiar truism that "an increase in the quantity of gold tends to decrease the value of gold," which is true only when all other conditions remain equal. There are two things that the 'quantity of money' doctrinaires have not faced squarely. One of these is the influence of the degree in which man-power is utilized upon the price-factor as determined by the per-capita circulation; the other is that the consuming power, which grows with the stimulus of productive energy, itself a coincident phenomenon with high prices, necessitates rapid provision of circulating media in adequate quantity to accommodate the size and to facilitate the velocity of trading at a period of high industrial activity. Accordingly credit-money then occupies the breach, and the total exchange accomplished through the credit-system represents, in effect, an expansion of currency enormous as compared with its gold foundation. This is well enough while confidence lasts; it is when a decrease is felt in the demand for commodities or in the opportunity for the profitable development of resources, which had made possible the increase in productive effort with its co-ordinate train of abundant money and high prices, that the balancing of credits and debits in widespread liquidation does in truth "test the soundness of currency." What we have learned during the War is that we have dared to stretch our credit-money to nearly 30 times the volume of the metallic basis. Gold serves not only as a measure of value but as a measure of credit, and we have found that it never had been used to its limit for the second function. Now that we no longer fear the arms of the Hun we are inclined to dream; amid the hopes of social reform the 'market-gauge dollar' theorists are obscuring the sober issues that we may have to face in the days of reconstruction. To appreciate the true importance of gold we must solve the last term of the equation of human necessity; we must open our eyes to a vision of what it would mean to have actual gold rather than mere credit-money in a country that, for a season, had lost its balance, that might be harried by revolution and disorder, such for example as Mexico; we must consider what gold in the vaults would mean today to Austria, torn by the war in which she has sunk to the position of a German vassal, stripped by her Prussian master of the last ounce of gold, so that she possesses nothing wherewith even to pay indemnities or to rehabilitate industry. She can do nothing but submit to effacement and to let the Allies administer the remnants of her empire if she should surrender; her alternative is to fight until she is destroyed with Germany. She is reaping the just reward of her policy, but it is worth while to note the liberty of choice it would give her for swinging from the Teutonic column if her treasury had retained its pre-war stock of gold. A nation's integrity rests upon its financial strength. It was the boast of the bankers at Chicago that we could, if necessary, raise three hundred billions of dollars with which to fight the battles of democracy, and still survive. That was the challenge made in the consciousness of productive power, but beneath it lay the bankers' belief in credits, based in the last analysis upon our ability to liquidate in gold. That is the foundation of political and economic self-determination, and to underwrite that insurance upon our freedom means to uphold the industry of gold mining.

Doing Their Bit

The American mining engineer has been so often engaged in professional work for British companies in other lands, notably South Africa, and he has had such pleasant relations with the other English-speaking members of the profession, that he was in sympathy with the British as against the Germans even before the United States joined the Allies in the fateful struggle that has embroiled the world. Therefore it has been a cause of satisfaction to him to recognize the splendid part played by the 'old country' to which, despite Germanized schoolbooks, the United States owes much of her best blood, her language, her common law, and the ideas of liberty for which Englishmen fought long before a stupid German king and his reactionary ministers caused a political cleavage that in any event was inevitable sooner or later, for the young giant of the West could not have been held in apron-strings to Britannia for long. The Revolution was a family quarrel, between two parties of British, and the Fourth of July celebrates the assertion on this side of the Atlantic of those rights for which the men of our race fought from Magna Charta to the Reformation. Therefore it is timely to correct the insidious attempt of the German propagandists to make it appear that England has been playing a sordid part in the great melodrama, the first scene of which was laid at Sarajevo on June 28, 1914. For instance, it has been said by the pro-

Germans that "Britain will fight to the last Frenchman," as if the British, and the English particularly, were saving their skins at the expense of their Allies. In August 1914 Great Britain's army consisted of 700,000 men, of whom only 250,000 were Regulars, 200,000 were Reserves, and 250,000 were Territorials, or Militia. Since then and up to last March she has raised 7,500,000 fighting men, of whom 5,041,000 enrolled themselves voluntarily. Of the grand total England alone has contributed 60.4%, or 69.5% if the troops from Africa and India are excluded. Great Britain has enlisted in her army and navy one out of every three males. England has given one in 7½ of population; so has Scotland; Wales has given one in 10.2, and Ireland one in 26.3, while the contingents from overseas represent one in 15. The British forces in the field last November showed a big proportion of English, not only in numbers but in casualties, thus:

	Armed forces	Casualties
	%	%
England and Wales	70	76
Scotland	8	10
Ireland	6	6
Overseas Dominions	16	8

In August Mr. Lloyd George stated that the number of men raised for the Army and Navy was 8,500,000, of which 6,250,000 are credited to the United Kingdom, 1,000,000 to the Dominions, and 1,250,000 to India. The last figure suggests the character of a large part of the troops employed in Mesopotamia, Palestine, and Egypt.

When the first slander proved baseless, the German propagandist suggested that the English were letting the Canadians and Australians do all the hard fighting, yet the English casualties since the beginning of the War have been 8.57% more than their proportion, whereas the overseas troops have had casualties proportionately one-half, as shown above. The fact is that the English were so proud of the manner in which their kinsmen hastened to aid the mother country, and so proud of their valor in battle, that they 'featured' them in dispatches from the front and in the accounts telegraphed by newspaper correspondents. So often were the Canadians and Australians mentioned, with enthusiastic praise, that the pro-German had a chance to misrepresent the facts and impose a monstrous lie upon the credulity of the ill-informed. The whole British Commonwealth has spilled its best blood lavishly for the cause of human liberty, as the casualties testify:

From August 1914 to the end of 1915	550,000
In 1916	650,000
In 1917	800,000
In 8 months of 1918	750,000
	2,750,000

This total does not record the wounded that have returned to active service. The sum of all the casualty lists is about 4,000,000. It is reported that the dead number 900,000, and the permanently crippled 600,000. In 1917 the British casualties were 500,000 more than the French. During the week ending September 28, when this is written, the British casualties are stated officially to have been 25,089. During this war the soldiers of England have fought on 15 different fronts, from Flanders to Kiaochau. If the military performance has been so sincere, what shall be said of the service done by the British navy? This: that the War against Germany will have been won primarily by that navy. If the Enemy had not been contained within his borders by the warships of Britain the aid of her own armies could not have been given to France, nor could the American armies have had a chance to deliver the decisive blow. The British Admiralty is reticent, but we do know that the tonnage of the Navy has been increased from 2,500,000 to 8,000,000 in the course of four years. In one month British warships in the aggregate have traveled over a million sea-miles in home-waters alone, while auxiliary vessels in their work of patroling have gone 7,000,000 miles during the same period. The Enemy has been driven off the ocean, and every neutral vessel is subject to inspection. In one month of 1917 not a single vessel trading with neutral countries crossed the Atlantic without being held up and examined. That will have proved an important factor in bringing the War to a victorious conclusion. Of the warships engaged in warfare against the Enemy's submarines in the eastern Atlantic 80% are British; of the miscellaneous patrol craft 86% are British; and of the ocean convoying work 70% is British. Moreover, as against the indiscriminate assassination practised by the German submarines and raiders, the British navy has not caused the loss of a single Neutral life. Great Britain has raised $36,750,000,000 for the War, and of this has loaned eight billion dollars to her Allies and over a billion more to her overseas Dominions. Next March the National Debt will be 40 billion dollars, as against 3¼ billions in August 1914. The excess-profits tax is 80%. It is estimated that the average British business man is contributing three-quarters of his income in various taxes, rates, and subscriptions. The income-tax and excess-profits tax alone aggregate $1,000,000 per hour of every working-day. Our great Ally has spent her money and her blood without stint in a dogged determination to see this thing through. Any suggestion otherwise is of pro-German origin, for it needs no second-sight to discern the truth that most of the effort to make trouble with England comes from the friends of the Enemy. It is time to realize the fact that to asperse an Ally is a subtle form of disloyalty to the Cause, if not to the Nation. Hearst and his yellow press played on that rotten string until it broke. The figures that have been quoted are eloquent in themselves, and we shall probably please our friends across the Atlantic by omitting any panegyric. The best report on the case will come from eye-witnesses, from our own gallant soldier-boys when they return home. We look to a comradeship between the British and American soldiers, aided by a common language, and by other things less palpable, that shall be not only the symbol, but the means, of a friendly understanding, the cornerstone of a Palace of Peace more real than that ironic structure constructed at the Hague. Then will have come true the wish expressed by Thomas Jefferson to James Monroe; the writer of the Declaration of Inde-

pendence stated in a letter to the President with whose name is associated the cardinal principle of American policy thus: "With her [Great Britain] then, we should most sedulously cherish cordial friendship, and nothing would tend more to knit our affections than to be fighting once more, side by side, in the same cause." That day has come, and we thank God for it!

Mining Law

International mining law has been discussed in a luminous manner recently by Mr. Theodore F. Van Wagenen. We publish a review of his interesting and suggestive volume elsewhere in this issue. For many years the revision of our Federal mining statute has been discussed; it has inherent defects that need correction; moreover, the legal status of various mineral deposits has been complicated by subsequent legislation, and confusion has been created by administrative orders in the interest of the Forest service and of those who have interfered with the development of phosphates, salines, petroleum, oil-shales, and other substances. The legal edifice displays lack of unity in design, by reason of the misconceptions of geologic facts in the original statute, the later Acts of Congress affecting specific minerals, Executive Orders, which, by virtue of their quality as decrees, constitute a species of law-making, and the surmounting entablature of judicial decision reared upon these fundamental columns. It may seem an undesirable moment, however, while the best thought of the Nation is concentrated elsewhere, for bringing this subject to the attention of Congress. On the other hand, as suggested by our reviewer, himself an eminent lawyer, the complicated economic policies to be compressed into the treaty that will attempt to establish international peace on a secure foundation after the War can hardly fail to include the conditions under which the mineral wealth of the world is to be distributed for the welfare of mankind. Control of metallic resources was a principal objective of the German plans for war; to secure them she spun a web of banking, smelting, and metal-trading corporations that covered the earth. In its meshes mines and reduction works in every country were caught like unsuspecting flies. Germany failed, however, to appreciate the value of gold mines, which vitalized banking organizations that have been able, by means of the monetary power available for expanding credits, to encourage industry, to gather the fruits of the earth, and to distribute them by the natural mechanism of trade, without resort to the commandeering of labor and supplies. This metallic resource has preserved the commercial and financial structure of the Allies through the stress of war, without sacrificing the freedom and initiative of the democratic peoples now leagued for self-preservation. Germany tried to grip us with tools made from the product of the mine, but she failed to control the one metal from which is developed, like steam from water, the motive power of the industrial mechanism. We see how intimately the peace of the world is related to the development and control of its mineral resources, and how the misuse of the legal privileges affecting them may imperil the safety of nations and the progress of civilization. Problems of this kind are likely to come forward at the council-table; and those best informed will best know how to deal with them. Consideration at this time of the fundamental questions of national and individual rights in minerals will prepare the way for dealing justly and wisely with the proprietary rights in the minerals and the manner in which they may be acquired and held. The democratic spirit is expressed in the accentuation of individual right; reasonable limitation of individual right is in line with a proper regard for the purpose of of democratic government; but the control of mineral wealth as inalienable State property, to be operated under the narrow concessions of leaseholds, is in line with that spirit of social and industrial organization which Germany so readily employed for imperial aggrandizement. We are pleased to note that Mr. Van Wagenen declares for the tenure of mines in fee-simple. We believe that this principle will be extended after the War, for the kind of democracy that then will be cultivated is that which depends upon organized individualists, not upon servile pawns whose will and initiative have been submerged in socialistic bureaucracies. It was Paul Milyoukov who pointed out that the only change to be expected from the rise of so-called democracy in Germany would be the substitution of the "intelligent absolutism" of the people in place of the military autocrat. This points a moral, though we dissent from the application of the word 'intelligent', because we do not believe that intelligence develops under collectivism. The one great universal stimulus to intelligence, in man and brute, is, and always has been, peril; it is the reaction for self-protection. We believe that virile individualism will increase the glory and right growth of America, England, and every other country. One of the essentials to individualism is the absolute right and legal recognition of ownership in property. The system of concessions has flourished widely; those that argue from precedent have the advantage there; nevertheless the principle is unsound, and will be out of harmony with the new democratic spirit. The tendency to introduce concessions for titles has grown too far already. Even in time of war, the subject deserves consideration, because we need to appreciate the interest of all nations in each nation's mineral resources and the conditions affecting economic exploitation. Our system of holding mining claims without performing a proper amount of development work has been criticized justly and has been used as an argument in favor of the leasehold, but the desired end, which is the discovery of mineral resources and the production of metals for the good of the people, can be served better through requiring the claim-owner to complete his title, by proceeding to patent, within a limited period. This is but a single example, yet it touches the vital point in what most concerns the world in its consideration of mineral deposits, namely utilization.

Savings v. Savagery

By RUDYARD KIPLING

[Change the pound to the dollar, 5% to 4¼%, and Great Britain to the United States; then reach for your check-book and make out a subscription to Liberty Bonds.—Editor]

A Story

*If you will allow me, I will tell you a story. Once upon a time, a hundred years ago, there was a large and highly organized community in India who lived by assassination and robbery. They were educated to it from their infancy; they followed it as a profession, and it was also their religion. They were called Thugs. Their method was to disguise themselves as pilgrims, or travelers, or merchants, and to join with parties of pilgrims, travelers, and merchants moving about India. They got into the confidence of their victims, found out what they had on them, and in due time—after weeks or months of acquaintance—they killed them by giving them poisoned foods—sweetmeats for choice—or by strangling them from behind as they sat over the fire of an evening, with a knotted towel or a specially prepared piece of rope. They then stripped the corpse of all valuables, threw it down a well or buried it, and went on to the next job.

At last things got so bad that the Government of India had to interfere. Like all Governments, it created a Department—the Department of Thuggee—to deal with the situation. Unlike most Departments, this Department worked well, and after many years of tracking down and hanging up the actual murderers, and imprisoning their spies and confederates, who included all ranks of society, it put an end to the whole business of Thuggee.

The world has progressed since that day. By present standards of crime those Thugs were ineffective amateurs. They did not mutilate or defile the bodies of the dead; they did not torture, or rape, or enslave people; they did not kill children for fun, and they did not burn villages. They merely killed and robbed in an unobtrusive way as a matter of education, duty, and religion, under the patronage of their goddess, Kali the Destroyer. Very good.

German International Thuggee

At the present moment all the Powers of the world that have not been bullied or bribed to keep out of it have been forced to join in one International Department to make an end of German international Thuggee, for the reason that if it is not ended life on this planet becomes insupportable for human beings. Even now there are people in England who find it hard to realize that the Hun has been educated by the State from his birth to look upon assassination and robbery, embellished with every treachery and abomination that the mind of man can laboriously think out, as a perfectly legitimate means to the national ends of his country. He is not shocked by these things. He has been taught that it is his business to perform them, his duty to support them, and his religion to justify them. They are, and for a long time past they have been, as legitimate in his eyes as the ballot in ours. This, remember, was as true of the Germans in 1914 as it is now.

People who have been brought up to make organized evil in every form their supreme good, because they believe that evil will pay them, are not going to change their belief till it is proved that evil does *not* pay. So far, the Hun believes that evil *has* paid him in the past, and will pay him better in the future. He has had a good start. Like the Thug, the Hun knew exactly what he meant to do before he opened his campaign against mankind. As we have proof now, his poisoned sweetmeats and knotted towels were prepared years beforehand, and his spies had given him the fullest information about all the people he intended to attack. So he is doing what is right in his own eyes. He thought out the hell he wished to create; he built it up seriously and scientifically with his best hands and brains; he breathed into it his own spirit that it might grow with his needs; and at the hour that he judged best he let it loose on a world that till then had believed there were limits beyond which men born of women dared not sin.

When the Veil is Lifted

Nine-tenths of the atrocities Germany has committed have not been made public. I think this a mistake. But one gets hints of them here and there—Folkestone has had more than a hint. For instance, we were told the other day that more than 14,000 English non-combatants—men, women, and children—had been drowned, burned, or blown to pieces since the war began. But we have no conception—and till the veil is lifted after the War we shall have no conception—of the range and system of these atrocities. Least of all shall we realize, as they realize in Belgium and occupied France just across the water, the cold organized miseries which Germany has laid upon the populations that have fallen into her hands, that she might break their bodies and defile their souls. That is part of the German creed. What understanding is possible with a breed that has worked for and brought about these things? And so long as the Germans are left with any excuse for think-

*A speech delivered at Folkestone, England, on February 15, 1918.

ing that such things pay, can any peace be made with them in which men can trust? None. For it is the peculiar essence of German kultur, which is the German religion, that it is Germany's moral duty to break every tie, every restriction, that binds man to fellow-man, if she thinks it will pay. Therefore all mankind is against her. Therefore all mankind must be against her till she learns that no race can make its way or break its way outside the borders of humanity.

A Hell Without Hope

The more we have suffered in this War the more clearly do we see this necessity. Our hearts, our reason, every instinct in us that lifts us above the mere brute, shows us that the War must go on. Otherwise earth becomes a hell without hope. The men, the ships, the munitions must go forward to the War, and behind them must come the money, without which nothing can move. Where our hearts are there must our treasure be also.

There has been a great deal of money spent in England lately, several millions a day for the last twelve hundred days. That means that many people have had the chance of earning more money—in some cases very much more money—than they could have earned in peace time. But all the money in the world is no use to a man or his country if he spends it as fast as he gets it. All he has left is his bills and the reputation of being a fool, which he can get much more cheaply in other ways. There's nothing fine or funny in throwing away cash on things you don't want merely because the cash is there. We've all done it in our time and we've all had to pay for it. The man who says he never worries about money is the man who has to worry about it most in the long run, and goodness knows there's enough worry in the world already without our going out of our way to add to it. Just now we all have the opportunity of protecting ourselves against private and public anxieties by investing as much as ever we can in War Loans.

Money Sits up all Through the Year

Money is a curious article. Have you ever thought that invested money is the only thing in the world, outside the Army, the Navy, and the Mercantile Marine, that will work for you while you sleep? Everything else knocks off, or goes to bed, or takes a holiday at intervals, but our money sits up all through the year, working to fetch in the 5% interest that the Government gives on every pound it borrows from us. I am not a financier, but I do know that much, and I do know that a man who has an income, however small, from money he has saved, is free of worry and anxiety for himself, his wife, and his children, up to the extent of that income. It gives him self-respect, a more even temper, a reason for looking at the future with calm and confidence. A man who has wasted or muddled all his pay at the end of the week is the servant of the whole world for his next week's pay. The man who has his bit in hand is independent of the world as far as that bit goes, and that knowledge at the back of one's head must make life a different affair to every thinking man or woman.

Savings represent much more than their mere money value. They are proof that the saver is worth something in himself. Any fool can waste, any fool can muddle; but it takes something of a man to save, and the more he saves the more of a man does it make him. Waste and extravagance unsettle a man's mind for every crisis; thrift, which means some form of self-restraint and continence, steadies it. And we need steady minds just now.

Remember, too, that everything we waste in the way of manufactured goods, from a match upward, as well as everything we buy that isn't absolutely necessary to get on with, means diverting some man or woman's time and energy from doing work connected with the War. And war work, which means supplies, food, munitions, ships, is the only thing that is of the least importance now. Everything outside that necessity is danger and waste.

So you see we are all in a splendid position to invest. Not only is there more money going about and fewer things to buy with it, but it is also wrong to spend money on what there is available. The road has been cleared of all obstacles to saving. The interest on what we save helps to make us personally independent; the money we lend to the Government helps to set our land and our world free. Our security for our loan is not only the whole of the British Empire, but also the whole of civilization, which has pooled its resources in men, money, and material to carry on this War to victory. Nothing else under heaven matters today except that the War should go on to that end.

The Personal War Aim

From time to time the representatives of the Allies meet together and lay down what the War aims of the Allies are. From time to time our statesmen repeat them. They all agree we are fighting for freedom and liberty, for the right of small States to exist, and for nations to decide for themselves how they are to be governed. All this we understand and perfectly believe. That is the large view of the situation. What is the personal aspect of the case for you and me? We are fighting for our lives, the lives of every man, woman, and child, here and everywhere else. We are fighting that we may not be herded into actual slavery such as the Germans have established by force of their arms in large parts of Europe. We are fighting against eighteen hours a day forced labor under the lash or at the point of the bayonet, with a dog's death and a dog's burial at the end of it. We are fighting that men, women, and children may not be tortured, burned, and mutilated in the public streets, as has happened in this town, and in hundreds of others. And we will go on fighting till the race that has done these things is in no position to continue or repeat the offence.

If for any reason whatever we fall short of victory—and there is no half-way house between victory and defeat—what happens to us? This. Every relation, every understanding, every decency upon which civilization has been so anxiously built up will go—will be

washed out, because it will have been proved unable to endure. The whole idea of Democracy—which at bottom is what the Hun fights against—will be dismissed from men's minds, because it will have been shown incapable of maintaining itself against the Hun. It will die; and it will die discredited, together with every belief and practice that is based on it. The Hun ideal, the Hun root-notions of life, will take its place throughout the world.

If We Fail—

Under that dispensation man will become once more the natural prey, body, and goods, of his better-armed neighbor. Women will be the mere instrument for continuing the breed: the vessel of man's lust and man's cruelty; and labor will become a thing to be knocked on the head if it dares to give trouble, and worked to death if it does not. And from this order of life there will be no appeal, no possibility of any escape.

This is what the Hun means when he says he intends to impose German kultur—which is the German religion—upon the world. This is precisely what the world has banded itself together to resist. It will take every ounce in us; it will try us out to the naked soul. Our trial will not be made less by the earnest advice and suggestions that we should accept some sort of compromise, which means defeat, put forward by Hun agents and confederates among us. They are busy in that direction already. But be sure of this: Nothing—nothing we may have to endure now will weigh one featherweight compared with what we shall most certainly have to suffer if for any cause we fail of victory.

Potash Deposit in Chile

*In the province of Tarapacá in northern Chile exists a deposit of salts containing large amounts of potash. This is known as the Salar de Pintadas, constituting a portion of the Pampa del Tamarugal, at an elevation of 3200 ft. above the sea. The area of the saline is approximately 1300 acres. The western boundary is formed by the Coast Range, which at this point consists of high escarpments. On the west it merges into the more elevated parts of the Pampa. Toward the south the saline is broken into a series of basins extending to the salar of Bellavista. The surface is covered by a hard crust of clay and earth mixed with salts of chloride of potassium and sulphate of sodium. The thickness of the crust varies from two to three feet. Below this is a deposit of crystalline white salt, about one foot thick, followed downward by six to eight inches of sand, containing small amounts of salt. Below that is a deposit of wet clay. This section is characteristic of the entire deposit. The argillaceous material in the crust represents wind-borne dust, which is caught by the moisture present in the basin. The distribution of the potash has been remarkably uniform. The crust contains as a rule from 2 to 3% of potassium chloride, although at many points the proportion rises to 10%. The white crystalline salts below the crust are usually richer, 10 to 15% being not uncommon, and rarely falling as low as 4%. Analyses by Enrique Taulis of the School of Agriculture at Santiago, give the following average:

	%
Moisture (at 110° C.)	5.000
Insoluble	1.324
Chlorine	37.861
Sulphuric anhydride	15.334
Lime (in terms of calcium)	0.272
Carbon di-oxide	0.134
Sodium	29.533
Potassium	7.409
Magnesium	trace
Oxygen (calculated to sulphates)	3.066

Reducing this to the corresponding salts present, and comparing the result with the analysis of the carnallite deposits in Germany, the deposit shows some advantages in composition, as seen in the following table:

	German Carnallite %	Chilean Salar de Pintadas %
Potassium chloride	15.5	14.15
Magnesium sulphate	12.1	....
Magnesium chloride	21.5	....
Sodium chloride	22.4	51.45
Calcium sulphate	1.9	0.93
Sodium sulphate	...	28.29
Insoluble	0.5	1.32
Moisture	26.1	5.00

The absence of the salts of magnesium, which are extremely soluble, removes one great difficulty in the purification of the Chilean product, since potassium chloride is relatively insoluble in water between the temperatures of 20° and 32° C., while the sulphate of soda is highly soluble at those temperatures. It is therefore possible to dissolve out the sodium sulphate with but little loss of the KCl in the waste liquors. A recent investigation of this Chilean deposit of potash salt indicates a total quantity of 1,813,833 tons available for treatment, divided into the following grades: Salts containing 3% KCl 138,956 tons, 6% 818,797, 9% 709,513, 12% 173,826, over 12% 72,741 tons. The salts represent a concentration, in the lower basin of the Pampa del Tamarugal, of waters seeping through, and originating in the adjacent high Cordillera of the Andes. The source of the potash is in the great masses of liparite, which contain from 3 to 8% of K_2O. The region is absolutely rainless, so that it is impossible that the salts could have been brought in from the sea, and the constant humidity of the layer of sandy clay proves that the subterranean water reaches the crust by capillarity, where it deposits the salts on evaporation. Although the Pampa is dry, and receives no precipitation, there are almost daily storms in the high Cordillera from late December to March, in which the rainfall is heavy. At this period the low basins of the valley fill with water, and at times inundate large areas of the pampas. Accordingly there is an inclined water-table, or probably wide channels under the pampas, leading from the main drainage lines in the Andes, and these waters carry the salts dissolved from the decomposing potash-bearing liparite. Samples of water from wells sunk along drainage-lines that feed the saline have showed on analysis from 0.191 to 0.750 gm. of K_2O per litre.

*Abstract: Boletin de la Sociedad Nacional de Mineria, March 1918.

A MALLET COMPOUND LOCOMOTIVE, ON THE BINGHAM & GARFIELD RAILROAD, HAULING 50 CARS (3500 TONS) OF UTAH COPPER ORE

The Utah Copper Enterprise—I

History

By T. A. RICKARD

The Great Salt Lake was discovered in 1825 by James Bridger, a fur-hunter, while seeking the source of the Bear river. He tasted the brackish water of the inland sea and wondered if it were an arm of the Pacific ocean. The lake was first seen by the Mormons on July 24, 1847. A band of them, numbering 145 and led by Brigham Young, had migrated from Missouri in search of a new home. It is recorded that when Brigham Young stood on the summit of the pass over the Wasatch range and saw the valley of the Jordan outspread before him, he exclaimed: "It is enough; this is the right place." He had seen it in a vision, he claimed, and foresaw the future glory of the new Zion that was to be planted in that happy valley. The proper name of the Mormons is the Church of Jesus Christ of Latter-day Saints, a name adopted by them in 1834 while they were established in Missouri. This sect was founded by Joseph Smith, Jr., at Manchester, New York, in 1830, in consequence of a vision in which the Book of Mormon, in golden tablets, was revealed to him by the angel Maroni, the son of Mormon, both of these, it is alleged, having survived a fierce war waged between groups of Hebrew settlers that came to America from Jerusalem viâ Chile. At one time the word Mormon was supposed to represent the English transliteration of the Greek word *mormoo*, but Joseph Smith denied this derivation, and said that it came from the Egyptian *mon*, meaning good, and the English word 'more', abbreviated to 'mor', so that it meant literally 'more good'! By the end of 1848 the Salt Lake settlement had a population of 5000.

The Mormons thought to escape the jurisdiction of the United States government, but they were thwarted by the treaty of Guadalupe Hidalgo, signed on February 2, 1848, at the close of the Mexican war. By this treaty Mexico ceded an immense stretch of Western territory to the United States, including the region over which Brigham Young and his followers had but lately established control. Early in 1849 the Mormon community was organized as the State of Deseret, with Young as Governor. According to the Book of Mormon the word 'Deseret' means "land of the working bee"—a good symbol for this industrious people and one that is perpetuated by the beehive that now appears on the seal of the State of Utah. Deseret comprised not only the Utah of today but also Arizona, Nevada, and parts of New Mexico, Colorado, Wyoming, and California. Brigham Young claimed a sway imperial in its perspective. In 1850 Deseret was admitted into the United States as the Territory of Utah; it had shrunk in area, but still included portions of New Mexico, Colorado, and Wyoming

On January 4, 1896, the present State of Utah was organized and admitted into the Union. The word Utah is a corruption of Ute, a Shoshone Indian tribe. I shall end these references to the early days of the City of the Saints by quoting a description of the Salt Lake valley as it appeared to the famous traveler Sir Richard Burton on August 25, 1860, when he stood in Emigrant Gap, or 'Emigration Kanyon,' as he called it. Burton wrote in his diary[1] thus:

"The sun, whose slanting rays shone full in our eyes, was setting in a flood of heavenly light behind the bold jagged outline of Antelope Island, which, though distant twenty miles to the north-west, hardly appeared to be ten. At its feet, and then bounding the far horizon, lay, like a band of burnished silver, the Great Salt Lake, that still innocent Dead Sea. South-westward also, and equally deceptive as regards distance, rose the boundary of the valley plain, the Oquirrh Range, sharply silhouetted by a sweep of sunshine over its summits, against the depths of an evening sky, in that direction so pure, so clear, that vision, one might fancy, could penetrate behind the curtain into regions beyond the confines of man's ken. In the brilliant reflected light, which softened off into a glow of delicate pink, we could distinguish the lines of Brigham's, Coon's, and other kanyons, which water has traced through the wooded flanks of the Oquirrh down to the shadows already purpling the misty benches at their base." Since then many shadows have crossed the range, but the sunsets retain the same qualities of beauty, and the clear ether still provokes the imagination of man. Sir Richard spells 'canyon' in his own way and undoubtedly was misled by false analogy to speak of "Brigham's", instead of Bingham, canyon. He was exhilirated by the fresh mountain air, in common with every traveler, so that it seemed to him "Switzerland and Italy lay side by side." To him the Salt Lake valley, "this lovely panorama of green, and azure, and gold—this land, fresh as it were, from the hands of God," was worthy to be the Zion of the Latter-day Saints and even of later sinners.

The discovery and development of mineral deposits in the Bingham district, like that of the territory of Utah as a whole, was retarded by the opposition of the Mormons, who intended to make agriculture the basis of their development and therefore discouraged the search for minerals. "This opposition", as S. F. Emmons has said, "and the natural obstacles in the way of cheap mining, or of an economic reduction of the generally rather refractory ores, acted as an effectual bar to the development or even the discovery of the mineral resources of the Territory in its early days."[2] The transcontinental migration that followed the discovery of gold in California did not lead to any important find of ore in this region, because the leaders of the Mormon church were successful in preventing it, "fearing that the excitement and unsettling influence of mining would turn away their people from the more monotonous and peaceful occupations of agriculture and thereby interfere with their great work of reclaiming the desert, and fearing, also, that the restless and sometimes rather lawless class of people who are attracted by mining excitements might prove a disturbing element in the population and tend to subvert their almost autocratic authority."[3] Orson F. Whitney, a Mormon bishop, in his history of Utah, exclaims: "Who wished to see Deseret, peaceful Deseret, the home of a people who had fled for religious freedom and quiet to these mountain solitudes, converted into a rollicking, roaring mining camp? Not the Latter-day Saints!"

The logic of events proved too strong for the Mormons in Utah as it proved too strong also for the Boers in the Transvaal. Indeed, the analogy is not sufficiently appreciated. The Boers left the Cape Colony in order to escape from British control; they believed in the practice of slavery, quoting biblical authority therefor; and they wanted to have ample room for their pastoral industry. So they crossed the Vaal. The Mormons, desiring to escape from the legal control of established American communities, believing in the practice of polygamy, for which likewise they quoted the biblical text, and, hoping to develop a purely agricultural industry in an isolated region, migrated into the western wilderness and settled in the valley of the Jordan on the shores of the Great Salt Lake. Boer and Mormon* alike expected to remain detached from the civilization they had abandoned, each expected to establish his own way of living in the outer wilderness, each was disappointed and thwarted by the oncoming tide of industrial progress. The pioneers of mining, in their eager search for mineral wealth, invaded the Transvaal and Utah, at first peaceably and then aggressively, establishing themselves assertively as their numbers increased, until the long arm of modern progress, which neither Boer nor Mormon could defy, reached forth into the new communities and claimed suzerainty. Slavery was as repugnant to the Briton as polygamy was repugnant to the American. The maintenance of these practices undermined the status of the Boers and Mormons, respectively; it created a prejudice under cover of which the invading prospector was enabled to obtain protection, ending in the submersion of the political islands that the Boer and the Mormon alike had tried to create in the midst of a continent.

So Brigham Young failed to realize his purpose of establishing a separate people, but he succeeded, beyond his dreams, in laying the foundations of a thriving community on the shore of the great lake. Any disparagement of the Mormons on account of their opposition to mining or on the score of their polygamous practices must be coupled with a hearty admiration for their energy as pioneers and with high praise of their thrifty enterprise. To this day they set a good example to the

[1] 'The City of the Saints, and across the Rocky Mountains to California.' By Richard F. Burton; 1862.

[2] 'Economic Geology of the Mercur Mining District, Utah.' U. S. G. S., 1895.

[3] Ibid. Op. cit.

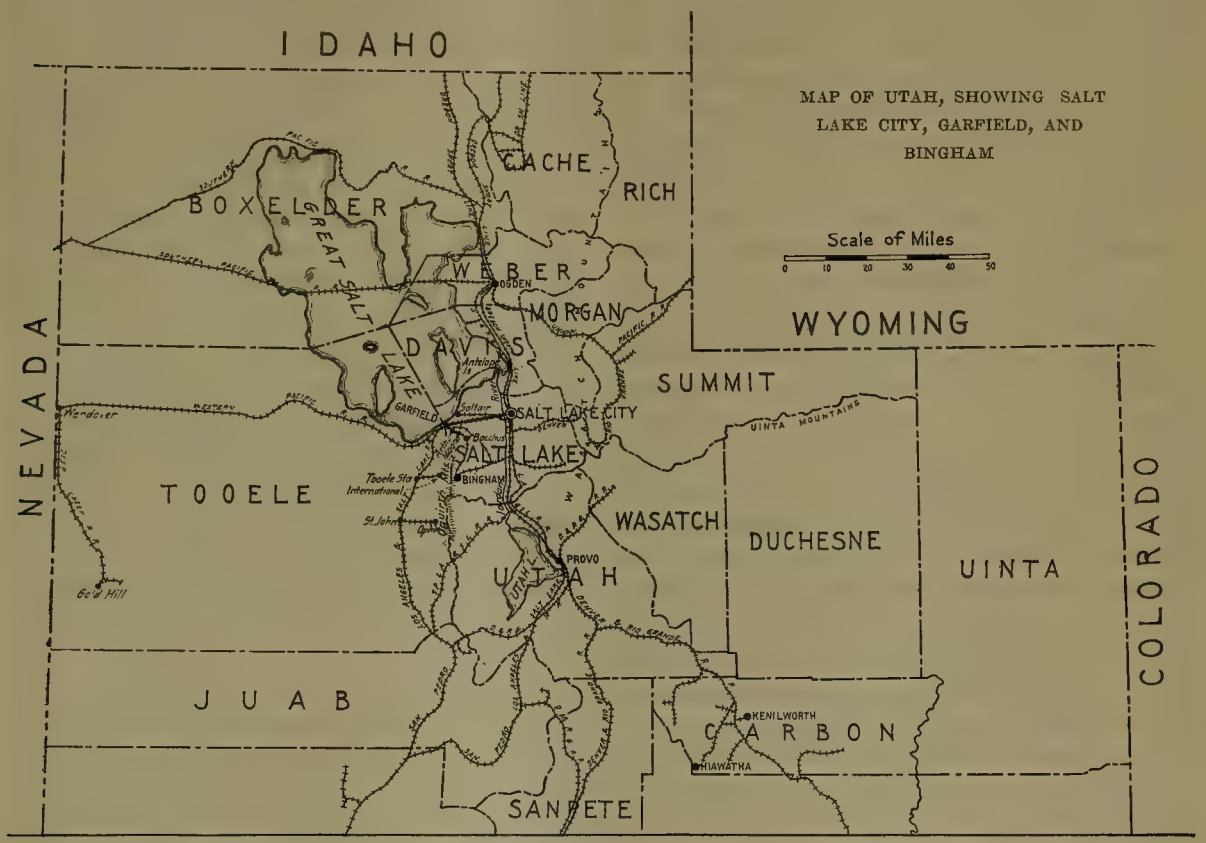
*It is worthy of note that the Mormon settlement included a large proportion of British.

people of the West by their intensive farming, collective loyalty, and intelligent co-operation.

The existence of silver ore near the Great Salt Lake became known in 1857, but Mormon influence prevented the development of mines. In 1862, during the Civil War, the Third California Infantry happened to become stationed at Fort Douglas, overlooking Salt Lake City. Many of the soldiers in this volunteer regiment had seen something of gold mining in California; their commander was Colonel Patrick E. Connor, who, it is said, looked to immigration to settle the Mormon question, then becoming acute. He encouraged prospecting and granted furlough to his men so that they had frequent opportunity for exploring the neighboring mountains, when not required to prevent depredations by the Indians—Piutes and Goshutes—and to keep an eye on the Mormons, who were unfriendly. Bancroft says:[4] "The first systematic efforts at prospecting, made by permission of General Connor,[5] when in command at Fort Douglas, were ridiculed in the Tabernacle, and later, when mining projects were brought forward by Gentiles, they were steadily discountenanced." Whitney says[6] of Connor: "His object was to reconstruct Utah, to put the Mormons under and render the Gentiles paramount. To effect that object he strained every effort of his energetic soul; hesitating not to grossly exaggerate, not only the growth of the infant industry of mining, making it appear a very giant at its birth, when everyone knows that for years it was a mere babe in arms, never attaining to any proportions until after the advent of the railway, but also the general condition of affairs at Salt Lake City and throughout the Territory."

At that time the Bingham district was known to the Mormons for its fine timber, red pine three feet in diameter being common. Early in the autumn of 1863 an apostate Mormon, George B. Ogilvie, found fragments of lead ore in the canyon and took them to Fort Douglas, where they were exhibited to General Connor. On September 17, 1863, the discovery was located as the 'West Jordan' claim, which was the first mining location made in Utah. In the following December a mining district, the first in the Territory, was organized under the name of West Mountain, which is the English for the Indian word Oquirrh. It included the whole of the Oquirrh range.

Bancroft describes the discovery as follows: "In 1863 Captain A. Heintz and a party from Camp Douglas discovered argentiferous galena and copper in Bingham canyon, on the east slope of the Oquirrh range, near the Jordan, and about thirty miles south of Salt Lake City. A mine was located in September of that year by a man



MAP OF UTAH, SHOWING SALT LAKE CITY, GARFIELD, AND BINGHAM

[4] 'History of Utah', by H. H. Bancroft. Page 741.

[5] Bancroft anticipates Connor's promotion; he was appointed major-general of the Utah militia in 1870. He played a prominent and useful part in Utah's early history.

[6] 'History of Utah', by Orson F. Whitney; Vol. II, p. 111.

named Ogilvie, and in December following, a mining district was established, named the West Mountain, and including the portion of the range between Black Rock, at the southern end of Great Salt Lake, and the fortieth parallel. In 1871 this district contained 35 mines."

Whitney's description may be compared with the foregoing: "A party of soldiers from Camp Douglas were guarding some horses belonging to the garrison which [the horses, not the garrison—Editor] had been sent to graze in Bingham canyon. They were joined one day by General Connor and a picnic party of officers and their wives from Camp [Douglas], and one of the ladies, while rambling on the mountain-sides, picked up a loose piece of ore. The soldiers at once prospected the vein, discovered it, and sticking a stake in the ground made their location, since which Utah has been known to the world as a rich mining camp. Another account, by the historian E. W. Tullidge, states that a man named Ogilvie, while logging in the canyon, found a piece of ore, which he sent to General Connor, who had it assayed. It was then, according to Mr. Tullidge, that Connor organized his picnic party and proceeding to Bingham Canyon located the mine, which was named the Jordan. Soon afterward Connor wrote some mining laws and held a miners' meeting at Gardner's mill on the Jordan river, where the laws were adopted and Bishop Gardner elected recorder of the West Mountain mining district. Thus was the ball set rolling."

In June 1864 another mining district, the Rush Valley, was formed, covering the western slope of the range and leaving the eastern slope to the West Mountain district, a name that, despite its inappropriateness, has persisted to this day. In 1864 the West Jordan Mining Co. was organized under Californian laws, and vigorous prospecting was begun; but these early operations languished, in spite of several handsome outcrops of galena, because of the many obstacles to mining. The lack of railroad transport rendered all supplies excessively expensive; a shovel cost $2.50, a keg of powder, $100. Moreover Mormon influence was effective in discouraging the settlers in the Salt Lake valley from participating in the development of the lead deposits. The discovery of gold, in 1864, by a party of Californians, returning from Montana to spend the winter at Salt Lake, led to the systematic washing of the gravel in Bingham canyon. A nugget weighing a little more than an ounce was found and these alluvial operations altogether are said to have yielded $1,000,000 during the ensuing six or seven years.

The first mining at Bingham was prompted by the silver-bearing lead ore that outcropped on the hillsides, by the gold found in the gravel of the gulch, and also by the gold mined from quartzose lodes penetrating the limestone. In 1882 four stamp-mills had been built to crush this gold-bearing silicious ore. The success of the lead mining was due not only to the silver contents of the ore in such celebrated mines as the Jordan, Galena, and Winnemucca, but also to the deep oxidation of the mineral, yielding easily reducible carbonate ores even at considerable depth, in such mines as the Brooklyn, Lead, and Yosemite.

According to Bancroft, "the first shipment of ore from Utah was a carload of copper ore from Bingham canyon, hauled to Uintah, on the Union Pacific, and forwarded by Walker Brothers to Baltimore in June 1868." This was before the transcontinental railway was completed by the linking of the Union Pacific and the Central Pacific railroads at Ogden on May 10, 1869, and it was two years before Salt Lake City was joined to the main line by the construction of the Utah Central railroad. The mention of copper so early is interesting, for no large shipments were made until December 1896, when 5000 tons of sulphide ore was shipped from the Highland Boy mine. It is worthy of note that the original Highland Boy company was started as a gold-mining venture by Samuel Newhouse, as promoter, and Thomas Weir, as manager. These two had so little idea of developing a copper mine that they built a cyanide mill to extract the gold in the oxidized ore. This mill ran for several months, but it was not a success, largely because the copper, of which they had failed to take note in their experimental work, interfered with the recovery and caused an abnormal consumption of cyanide. After this mill proved a failure and the company's affairs reached a critical stage, Mr. Newhouse, it is said, went to Denver in order to raise money to meet his delinquent payrolls, and while there he received a telegram from Mr. Weir informing him that ore containing 15% copper had been struck in the lower adit. This saved the day. Another story asserts that in the course of exploratory work in the zone of oxidation a winze penetrated sulphide ore. This so alarmed the management that the winze was covered. Later, failing to develop a successful gold mine and the price of copper making it attractive, the winze was reopened and a discovery of copper-sulphide was announced.

At first the copper deposits were overlooked. They were of low grade and not as easily smelted as the lead ores. The shipment of copper-sulphide ore from the Highland Boy in 1896 gave the first promise of a new departure and led to the transfer of this mine, with other claims, to the Utah Consolidated Mining Co., which, three years later, completed a smelter of 250 tons capacity. In 1897 the Stewart No. 2 and a number of adjacent claims were acquired by the Boston Consolidated Mining Co. These are mentioned by J. M. Boutwell in Professional Paper No. 38, U. S. Geological Survey, and in that report he has an addendum bringing the record of development down to 1902, but there is no suggestion of the enterprise that was to give world-wide fame to Bingham.

It is probable that the first mining on the present Utah Copper property was done at the time when Colonel Connor's soldiers began to prospect in the hills enclosing Bingham canyon, that is, soon after 1862, for the Soldier Tunnel, by its name, perpetuated that tradition. The oldest claim now included in the property is the Washington, which was located in 1865, whereas the latest

claim, the Emma Fraction, was located in 1907, four years after the Utah Copper Company had been organized.

The story of the Utah Copper enterprise begins with Colonel Enos A. Wall, of Indiana. As he himself acknowledges smilingly, his military title is one that he owes to his friends. His parents were North Carolinian; he started his mining career in Colorado in 1860 and went from there to Montana in 1863, varying the search for gold with general business as a freighter and trader in the material and supplies exchanged between that Territory and Utah, to which he came in 1868, remaining for 14 years. Then for five years he was chief stockholder and superintendent of the Wood River Gold & Silver Mining Co., an important enterprise at Bullion, Idaho, where he won the regard of his fellow-citizens so as to be elected to the upper house of the Territorial legislature and become President of that body of Solons, as, I believe, a newspaper reporter would call them. In 1885 he returned to Utah, engaging in mining at Mercur and elsewhere.

In July 1887 he went to Bingham, where he noticed a number of prospecting drifts and inclines driven during early days on the small fissures that traverse the quartzite and monzonite on both sides of the canyon. His attention was attracted by a discoloration on the hillside, visible from the road. The stream of water issuing from a spring just above the site of the present 'pit' of the Utah Copper mine had been conducted to a placer near the site of the present railway station. The bare rock on the hillside had become discolored and the gravel in the gulch likewise was stained green by the coppery solution. Upon examination, the ridge of rock proved to be an outcrop of monzonite impregnated with copper sufficiently to assay 3% for a length of 300 ft. An abandoned 'tunnel', 90 ft. long, had been driven into the hill on about the level of the present 'pit'. This tunnel had followed a short-lived fracture that had yielded pieces of ore rich in chalcocite, but the work evidently had proved unprofitable. Entering the tunnel, Wall broke a sample; upon the fresh face of the rock, under the green coloration, he saw that the monzonite was impregnated with black specks of chalcocite and bornite, suggesting a similarity to the ores of Butte, with which he was familiar. He sampled the tunnel, omitting the 20 ft. next the surface, where the copper-bearing rock was oxidized, and obtained an average of 2.4% copper by assay. Numerous tests by panning showed that a concentrate assaying 30 to 40% copper could be produced.

Upon enquiring at the Recorder's office, he ascertained that a large part of the ground adjoining and surrounding this exposure of mineral had been abandoned and therefore was subject to re-location; so he staked two claims, which he named 'Dick Mackintosh' and 'Charles Read', after two of his local friends. This gave him an area of 3000 by 600 ft., except a small fraction subject to conflict at one end. Subsequently he located another adjacent claim, which he named the 'Frank Cushing'. He found other old workings, one of them being a tunnel 250 ft. long on the opposite, or east, side of the gulch. This was nearly on the same level and about 700 ft. northeast of the one first inspected; it followed the so-called Quinn fissure, a gash marked by an irregular enrichment with chalcocite, similar to many other short-lived fractures traversing the monzonite mass. The ore in this fissure assayed 5 to 40% copper, but it was not in quantity sufficient to justify the method of selective mining that the former owner of the claim had attempted to apply. A new tunnel 600 ft. northward and on the same side of the gulch had been driven 200 ft., and was in continuous ore averaging 1.8% copper. These facts indicated an extensive dispersion of the copper. He investigated the titles of the claims adjacent to his own locations, meanwhile keeping his hopes to himself. He even agreed with the road-supervisor that the dumps be used for road-making, being willing to have the value of the ore ignored. The local wits called it 'Wall-rock'.

At that time he did not have enough money to start systematic development, but, from year to year, he did his assessment work. Later he made some money by sundry deals at Ophir and Mercur. For example, he sold the Brickyard mine, at Mercur, and cleaned up $60,000 on that. He developed the Yampa mine, near the Highland Boy, and made such a showing as to be able to sell it to George H. Robinson, for Moore & Schley, at a price of $150,000, as against the cost to himself of $40,000. He was not a promoter, but a miner and a dealer in mines, backing his personal judgment successfully and establishing a good bank-credit in Montana and Utah. He held to his faith in the copper-bearing 'porphyry' at Bingham, and looked forward, some day, to acquiring financial strength sufficient to enable him to provide the plant and equipment necessary to exploit the deposit on the large scale that it demanded. By aid of his winnings, he had been able to perform the assessment work on his own property as it became due; he had bonded other claims, and paid for some of them; so that when the success of the Highland Boy started a copper excitement in 1896 he had acquired ownership of 200 acres and had done $20,000 worth of exploratory work, as represented by about 5000 ft. of tunnels, drifts, and cross-cuts.

(To be Continued)

HYDRO-CARBONS are transformed into hydro-carbons of lower boiling point by bringing their vapors into contact with hot gases of combustion substantially free from oxygen. The hydro-carbon is thus subjected to a temperature of 700–3000° F. under pressures ranging up to 600 lb. per sq. in. The conversion is effected in a chamber into which a mixture of hydro-carbon and steam is sprayed by a nozzle, and the gases of combustion are led to a condenser. The gases of combustion are generated in a separate chamber fitted with a spraying device admitting oil or a mixture of oil and steam, having an inlet for air, and a pump for generating the requisite pressure. The method was worked out and patented by D. T. Day, F. Macdonald, and R. B. Day.

Similarities in the Legal Aspects of the Litigation Over Flotation, Cyanidation, and Filter Patents

By R. C. CANBY

*The very wide interest which present flotation litigation has evoked among the members of the mining and metallurgical profession recalls most vividly to mind the same general interest which was felt in the MacArthur-Forrest cyanide and the Moore filter cases. It may be of interest, therefore, at this time to recall briefly these two former cases, and to compare them and certain of their features with the present flotation litigation. We will find some interesting points which may help us to comprehend more readily the ethical elements of the flotation case.

There is in addition a coincidence—if not an actually premeditated connection—between the Miami flotation case and the Moore filter case, which has at least a strong human interest.

Briefly, the three cases may be stated as follows:

In the cyanide case, the MacArthur-Forrest patents were declared invalid for lack of invention in practically all countries, Mexico, however, being one of the exceptions.

The Moore filter patents were tested in a suit brought against the Tonopah Belmont Development Co. for infringement in their use of the Butters filter, a filter in which the filter-leaves were permanently fixed in the tank.

The U. S. District Court of New Jersey (Judge Rellstab) decided that the Butters filter did not infringe the Moore filter, but the Circuit Court of Appeals in Philadelphia reversed the finding of the lower court, sustaining the Moore patents in the very broadest sense.

In the flotation case, the U. S. Supreme Court has affirmed the validity of the Minerals Separation patent 835,120 in the Hyde case.

That this Supreme Court decision is to the effect that the process disclosed consists of a definite degree of agitation, a different character of froth product, in combination with a 'critical' amount of oil, was the conclusion of the Circuit Court of Appeals in the Miami case.

The Miami Copper Co., under my direction, had been conducting a series of flotation tests, at first with an air-compression method; then with a 50-ton Hoover type Minerals Separation agitation-froth machine; and at the same time, upon a limited scale, some experiments in a half-width, full-length, Callow cell, which I had built under Mr. Callow's instructions.

*A paper read before the recent annual meeting of the Canadian Mining Institute and published in the September bulletin of that Institute.

At the time we were experimenting with the 50-ton M. S. machine, the principal Minerals Separation patent No. 835,120 had been declared invalid by the U. S. Court of Appeals in San Francisco.

It was clearly understood that it was not the time to expect the Miami company to sign a contract acknowledging the validity of a patent that had thus been declared invalid.

As an indication, upon the part of the Minerals Separation's representatives, of a complete and cordial understanding of the Miami company's intentions, I may state that, when there was (at one time) a possibility that the Miami company might be obliged to temporarily shut-down its machine through lack of oil, the Minerals Separation representatives, of their own volition, offered to sell from their own supply such oil as the Miami company might need.

While the little 50-ton machine was of ample capacity to sufficiently demonstrate the suitability of the Miami ore to flotation, it was, upon the other hand, so insignificant an operation as compared with the Miami milling operations as to make it the merest technicality upon which to base an infringement suit; so the first Minerals Sparation suit came as from a clear sky, the bill of complaint including only the agitation-froth machine.

This first suit, however, later withdrawn and another suit instituted to include the second Callow experimental plant, which had been installed subsequently to the filing of the first suit.

As the suit was brought at Wilmington, Delaware, taking advantage of the fact that the Miami company was a Delaware corporation, one may well question if it were more than a coincidence that a suit upon this mere technicality should have been brought in this District Court, when one recalls that on the appellate bench of this district sat the very judge who had written the decision so broadly sustaining the Moore patents in reversal of such a sweeping opinion as that of Judge Rellstab.

However this may have been, it was apparent early in the Miami hearing before the Wilmington court that the plaintiff, Minerals Separation, was making every effort to present the Miami case along the lines of the Moore filter case.

This effort was especially evident in the discussion by counsel as to the admission of page after page of articles read into the court record from engineering journals by one of the plaintiff's witnesses, just exactly as had been done by plaintiff in the Moore filter case.

This tendency to line up the Miami case with the Moore

case was the more noticeable because of the fact that one of M. S. counsel in the Miami case had been counsel for the defendant in the Moore case, upon which side of that case it is presumable that he must have contested the very attitude now so eagerly pressed by Minerals Separation's counsel.

As we have seen, the defence in the Moore case had won a most signal victory in Judge Rellstab's decision in the lower court, but, upon reaching the Circuit Court of Appeals, Judge Buffington reversed the lower court, setting forth very prominently in his opinion the utility of the invention.

Accordingly, one can see that, no matter upon which side of the Moore case the learned counsel above referred to may have been, it is natural to presume that he must have been most strongly impressed by, and possibly hopeful of, a similar point of view from the same court in the Miami case following a similar presentation.

One cannot, of course, claim that M. S. counsel actually had any idea or expectation, or that the Miami suit was purposely staged in the Third District with the intent of obtaining its ultimate decision from a court in which sat the judge who had so signally sustained the Moore patents.

Upon the other hand, it is perfectly reasonable to assume that no suit against the Miami would have been brought in Arizona, where the alleged infringement had taken place, since this would have taken an appeal to the Circuit Court of Appeals in San Francisco, which court had declared Minerals Separation patent invalid.

But whether the bringing of the Miami suit in the Delaware court was thoughtfully planned with a view to the personnel of the appellate court, or was merely a coincidence, there is no question that Judge Buffington of the Circuit Court of Appeals for that district is generally conceded to be one of the most able patent judges on the bench. It is, therefore, not presumable that so able a judge has been inconsistent in his method of arriving at the opinions in these two cases.

In the Moore case he unequivocally sustained the patents; whereas in the flotation case it was he who wrote the minority opinion, in which he strictly limited the M. S. patents to agitation by mechanical means.

Judge Woolley, in writing the majority opinion of the Court, held that an agitation, provided it was of sufficient degree of violence and duration to produce the result of the patents, was, in effect, the agitation of the patents, whether produced by mechanical impellers, or by air jets as in the Pachuca tank.

Judge Buffington, on the other hand, not only confined the agitation of the patent to that by strictly mechanical means, but further restricted it to that of the inflow Gabbett, or its mechanical equivalent.

It is on this question of mechanical agitation that there is a difference between the majority and minority opinions extending to all three patents in suit.

The Moore filter case was tried in a district court of the same circuit as the Miami, but in New Jersey Judge Rellstab found that five of the principal steps of the Moore process, including the depositing of the material upon the filter by suction, were old in the art and already disclosed in prior patents cited. It was true, he said, that these prior patents were apparatus patents, and that these steps were only functional, but "then, of course, Moore's steps are but functional."

Judge Rellstab considered it doubtful if Moore's process constituted such an advance in the art as to amount to invention, but he did not actually pass upon this point, since he came to the conclusion that the Butters filter, with its stationary leaves, did not infringe the Moore filter.

Judge Buffington, in his decision reversing Judge Rellstab, sustained the Moore filter patent as a process of cyanide treatment, the features being:

(1) Formation of a layer of pulp of uniform resistance to the flow of solutions.

(2) Withdrawing layer from the pulp (or pulp from the layer) while holding the layer against the cloth by continuing difference of pressure within and outside of cell. (This covers both suction and pressure-tank methods, like Kelly) when not submerged.

(3) Submerging in wash solutions.

(4) Discharge by reversal of current, that is, blowing instead of suction.

Approximately one-fourth of Judge Buffington's opinion in the Moore case consisted of the quotations from technical journals, to which I have referred, setting forth the baffling difficulties which treatment of slime had always presented in the cyanide process, and the very urgent need which there had been for such a process as Moore had developed, thus indicating the tremendous utility of the achieved process, a description of which he quotes from an article by George Moore, himself, published in the 'Engineering & Mining Journal' a year before his patent was issued.

Judge Buffington states that Moore realized the importance of the *uniform resistance* of the cake. He says:

"It is contended, however, that the Moore patent is invalid by reason of the prior art. But in our view this contention is based on a failure to recognize the true significance of what Moore really did. . . . To find, therefore, here and there in the prior art patents, and dissociated from each other, all the mechanical appliances of the combination apparatus which Moore illustratively used, is not to prove that Moore's process is not original."

Judge Buffington states that Moore realized the importance and scope of his invention, and that what had therefore been waste-dumps, had now become of immense value.

How readily one thus recognizes from whence came so many of the echoes, which were heard in Wilmington as to the reclaiming of vast dumps. Surely if Judge Buffington had in the Moore case the power to discern so clearly the invention and the fullness of its scope, we cannot question but that he had brought the same keenness of insight and the same accuracy of analysis to the study of the Miami case.

In the Miami case, after quoting Claim No. 1 (Patent

835,120): "Adding a small proportion of an oily liquid (amounting to a fraction of 1% on the ore) and agitating the mixture until the oil coated mineral matter forms into a froth, and separating the froth from the remainder by flotation," Judge Buffington adds:

"I say, putting aside all minor incidents, for it is perfectly clear that, if all kinds of air flotation and all kinds and degrees of agitation are covered by this claim, the infringement of the defendant is self-evident, and by their use of compressed air, which produces some agitation and causes air flotation. To my mind and for reasons which I shall now discuss this claim should not be awarded this sweeping scope which will paralyze the subsequent development of a great art."

Judge Buffington then points to the necessity in the patent law that the patentee "particularly point out and distinctly claim the part, improvement, or combination that he claims as his invention or discovery."

He says of Minerals Separation process as held valid and described by the Supreme Court:

"In substance, it was the disclosure of a process in which a hitherto unused minimum of oil and a hitherto unused maximum of agitation were used."

He then fully sustains the fact that the Supreme Court had decided "that first the quantity of oil; secondly, the character of agitation, and thirdly, the resultant froth constituted the disclosure."

He says, "This discovery is bottomed on agitation," and then he quotes quite voluminously from the record, largely from the evidence stipulated from the Hyde case, which shows how insistently the inventors of the process had dwelt upon violent mechanical agitation, agitation with a Gabbett agitator, and how that they had tried a centrifugal pump but found the Gabbett preferable. Judge Buffington then says:

"To our mind this use of the literalism and verbiage of the one word agitation to foreclose this whole controversy, loses sight not only of the spirit of the patent law, but also of the principles on which this contract—for a contract with the Government is what a claim is—should itself be interpreted, for in construing that contract one must construe it as a whole, that is the claims plus the specification, and not the claims minus the specification. We must also consider the claims in the light of the evolution of experiments that led up to the discovery and consequently to the disclosure."

"If they had discovered the broad principle of oil to coat minerals and to reject gangue; if they had discovered the coating of air bubbles with oil; if they had first shown that oil-coated minerals and oil-coated bubbles would unite and rise to the surface, we could regard them as first-comers into a newly-discovered field and as entitled to make all further progress in that art servient to those who created it."

When one considers that these words are the words of the same judge who sustained the Moore filter patents in reversal of Judge Rellstab, although one must fully realize that in the Miami case Judge Buffington's opinion is the minority opinion of the Court, nevertheless one cannot but feel that a comparison of these two opinions is most reassuring to those of us who resist the claims of Minerals Separation to a practical monopoly of flotation.

The MacArthur-Forrest process also has many points which may well be compared to the flotation situation.

In both instances one cannot but feel that while actual proprietorship is rightfully withheld, none the less ample credit has undoubtedly been given.

Referring to my article in the 'Engineering & Mining Journal' (December 1, 1917) I there said, "The mining world should not fail to give due credit to the gentlemen (of Minerals Separation) for their marvelous perception as to the possibility of such processes. . . ." And as to the cyanide process, it has been truthfully said: "To these men, MacArthur and Forrest, is due the praise, not that they were the first discoverers, but that they pushed their invention and enabled a recovery of $14,000,000 in five years by their process, which would have otherwise been lost."

Nevertheless, the solubility of gold and silver in cyanide had been known and utilized many years. The precipitation of these metals from their solution upon zinc had been known and used, and there had also been several patents issued describing processes for ore treatment by cyanide.

In this connection, it may be of interest that, so far as I know, the writer was the first to try cyanide in a commercially operating milling-plant. This was done at the Sierra Grande mill, Lake Valley, N. M., in which the Russell process of hyposulphite lixiviation was being practised. A short run was made with cyanide solution as a trial of the process for which Dr. F. M. Endich and Mr. Nicholas Muhlenberg had a caveat in the U. S. Patent Office. (See 'Mining and Scientific Press,' July 1, 1916.)

This trial antedated MacArthur-Forrest by several years. The silver extraction by this cyanide test upon the ore crushed as it was to such a coarse mesh did not, however, show a sufficient improvement over the results of the hyposulphite process to warrant the use of cyanide at its greater cost in those days.

I do not know why the Endlich-Muhlenberg caveat was abandoned. It may have been that they encountered the Rae and the Simpson patents, or that they concluded the process to be unpatentable. I remember discussing with Dr. Endlich the question as to whether or not already known chemical reactions could be patented, and showing him the reactions involved in his process in Prescott and Johnson's 'Qualitative Chemical Analysis.'

It is not necessary here to go into any description of Rae's or Simpson's process. The patent, which was taken out in 1885, was styled a "process for extracting gold and silver from its ores," and that these patents were regarded as disclosures, may be taken from the judge's query, "if the MacArthur-Forrest patent were held valid, would not Rae and Simpson's processes if now used be liable to be stopped as infringements? I think they clearly would."

Here I think we have a very close parallel. If the M. S. patent 835,120 were sustained upon any such

broad basis as, for example, Judge Bourquin's decision in the Butte & Superior case would give it, would not all of the previously disclosed flotation processes be also infringements?

There is another strong resemblance between MacArthur-Forrest patent and Minerals Separation, in that in each, among other things, is the claim to the use of a limited amount of the reagent—8 parts of cyanogen to 1000 parts of water, in the one case; and a fraction of 1% upon the weight of the ore, in the other.

In replying to a most interesting article by Mr. MacArthur ('Mining and Scientific Press,' June 10, 1916), if I may again be permitted to quote what I have previously said, I stated:

"I agree, however, most fully with Mr. MacArthur when he says 'cyanide does this (dissolves gold from its ores and holds it in solution) and so far as I know it is the only solvent that can do it. This is the real essence of the invention. The matter of weak or strong solution follows as a matter of chemical economy.' Such an expression from Mr. MacArthur is apropos in the present flotation litigation, in which it is contended against the pretentions of the patentee of the minute quantity of oil, that it is the flotation by the use of such reagents, that is the real essence of the process, the matter of more or less of the reagent being a matter of chemical and commercial economies." (July 1, 1916, 'Mining and Scientific Press.')

We have along this line a very interesting court decision upon the Walderstein patent (U. S. Patent No. 601,719, claiming the use of a "definite quantity" or the "exact quantity" of zinc dust necessary to exactly precipitate the metal). The decision of the Circuit Court of Appeals of the Ninth Circuit, June 6, 1902, the same court which declared M. S. patent No. 835,120 invalid, says: (117 F. R. 240.)

"The patentee, not being the inventor of the use of zinc dust by means of agitation as a precipitating agent, the public is free to use such quantity of as may be required to best produce the desired result."

It was because of the disclosures of the prior art and of such sound judicial opinions as this, as well as the ruling of the U. S. Patent Office in the case of their own application, which made it so necessary for Minerals Separation to thoroughly emphasize those features, other than the limited quantity of oil, and to testify so strongly as to the greater violence of the agitation of their process, and as to the different character of their froth product—to the combination of which three elements, the U. S. Supreme Court in its decision has definitely bound them.

That the U. S. Supreme Court has so defined their process was strenuously protested by counsel for Minerals Separation during the appeal argument before the Circuit Court of Appeals in the Miami case.

That this limiting of the process of the patent No. 835,120 to a combination of the greater degree of agitation and a different character of product in combination with the critical quantity of oil was the intention of the Supreme Court was affirmed however by the Court of Appeals in the Miami case, and, as we have already seen, Judge Buffington went even further than the majority opinion as written by Judge Woolley, and confined this agitation not only to a greater violence than that of the prior art, but agitation by a mechanical means with a down current Gabbett or its mechanical equivalent.

In this paper I have given much consideration to Judge Buffington's minority opinion, not only because of the interesting coincidences as to his having reviewed both the Moore filter and the Miami cases, but because of the real value of his judgment in helping to form one's own opinion as to the equities in the Miami case.

The Moore filter process was the successful solution of the problem of leaching and washing slime in cyaniding, and while it is true that, in flotation it is the slime that is particularly adapted to the process, it was not the treatment of slime particularly, however, that the various inventors of the flotation process had in mind.

As I suggested in my article in the 'Engineering & Mining Journal' (December 1, 1917):

"Might one not much more consistently claim proprietorship to flotation of a minute particle in modified water than to admit the patentability, simply, of a minute quantity of the modifying agent?"

But as it was not particularly the treatment of slime but broadly a system of ore-concentration that these inventors had in mind, no one seems to have thought of this at a sufficiently early time as a possibly patentable idea.

But George Moore was confronted in his actual work in a small cyanide mill, in which he was financially interested, by the slime problem. It was to the solution of this problem to which he set his inventive skill, and evolved a successful method of procedure, one which Judge Buffington recognized as a 'process'.

The patents cited as previous disclosures were apparatus patents, and for the most part antedated the cyanide problem. But more than that, Judge Buffington recognized that for the particular purpose for which the invention was intended to be used, as already quoted:

"The saving of extraction is due to the fact that while the filter is in the slimes tank and the suction in operation, an equalizing action is taking place."

And this he considered the gist of the invention.

In the Miami case, counsel for Minerals Separation had much to say about 'slimes' and had one of their witnesses read into the record from technical journals, exactly as the plaintiff had done in the Moore case, lengthy articles dwelling upon the problem that slime presented in the concentration of ores just as in the Moore case slime had been the obstacle to cyaniding.

There is nothing said in the M. S. patent, however, as to their having any advantage in, or being particularly applicable to the treatment of slime. The patent claims broadly that they apply to a system of ore concentration. Ore concentration as an art was not broadly patentable, nor was flotation broadly patentable. The Supreme

Court of the United States has, therefore, as we have seen, definitely confined Minerals Separation to the use of greater agitation than that of the prior art, in presence of a critical quantity of oil, resulting in a froth-concentrate of a different character from that theretofore produced. We have both the majority and minority opinions in the Circuit Court of Appeals in Philadelphia, in the Miami case, concurring in this interpretation of the Supreme Court decision in the Hyde case.

In this brief comparison of these three important patent cases I have not attempted to dwell in any detail upon the Court's decisions, having in mind more particularly the relative equities of the respective cases. The question in my mind has been that of our rights in the matter: Are we morally right in resisting the claims which are being made by Minerals Separation, Ltd., to a proprietorship of the field of flotation so broad as to include the bubble-column method, such as the Callow cell, for example?

I am confident that any impartial study of these cases will fail to disclose any conditions of the Filter case paralleling those of the Flotation case, and that the equities in the Flotation case will not warrant any rights being claimed by Minerals Separation, other than the strictly limited sphere which the U. S. Supreme Court's decision has marked out.

On the other hand, the Flotation case seems to me to parallel the Cyaniding case much more exactly. In each the reactions, or elements, were previously known. In each there is a question of quantity, or degree, of reagent.

The Supreme Court was led to believe certain facts, the non-existence of which has since been shown. It is probable that should this case again reach the Supreme Court, Patent No. 835,120 will meet the fate of the MacArthur-Forrest patents, and with it will fall the so-called soluble agent patent and its accompanying patent. It may be, as counsel for Minerals Separation said in argument in the Miami case, at Philadelphia, that if the bubble-column were free to use, no one would use their agitation froth method. But this is of importance solely to these men employed in exploiting flotation patents.

The patent laws of the country were and are designed to encourage inventive genius, not for the purpose of creating an unwarranted monopoly. The underlying principles of the patent law are well illustrated in the cases under discussion. As clearly shown, the patentees are entitled only to such fruits as the proper interpretation of their patents rightly give them and nothing more. If an invention is an improvement in an art, it will take its place in that art, but is subject to be displaced by the legitimate use of that which is old, as well as by that which may follow, having greater efficiency.

NITRATE production at the Government plant No. 1, Muscle Shoals, Alabama, is proceeding at the rate of 11,000 tons per annum. This is from the first unit of the plant only. The nitrogen is obtained by the synthetic process from ammonia and not from the air. Power is derived from one steam-plant delivering 6000 hp., and 30,000 hp. is transmitted to the works from the Warrior River plant of the Alabama company. The cost of the first unit of plant No. 1 was $5,000,000. Two units of plant No. 2 will be turning out nitrate in October. The capacity of this plant will be 133,000 tons of nitrate annually and its cost when completed will reach $30,000,000.

Tungsten-Gold-Copper Ore in Korea

The Seoul Mining Co., operating a profitable gold mine in Chosen, has a valuable asset in its Soctarie deposit, the principal mineral being scheelite. The report for 1917, just to hand, contains the following on this reserve:

The Soctarie deposit consists of an extensive band of quartzite, interbedded with limestone, with an average thickness of 25 ft. This band is mineralized with tungsten, gold, and copper. The grade is low, the average of all ore milled to date being approximately:

WO_3 (as scheelite), per cent	0.3
Gold, per ton	$0.40
Copper, per cent	0.4

The large size of the deposit, and the increasing demand for tungsten, makes it appear that this contains great possibilities. A large amount of experimental work was done both abroad and at the mine. The problem of separating the concentrate into marketable products was fairly well solved; but on account of the heavy cost of all chemicals at present, and the much increased transportation charges now ruling, also the comparatively small output, it was not found practicable to erect a refining plant at the mine. No Japanese metallurgical works could be found sufficiently enterprising to join in taking over and refining the company's products at anything but most exorbitant rates. Consequently, in May 1917, as complete data had been obtained, it was decided to temporarily suspend operations. On the closing down of the Suan mine (about end of 1918), the whole mill of 40 stamps will be available for the Soctarie ore, when certain alterations are made.

The entire scheme is governed by the price obtainable for tungsten. If the company could depend on receiving anything like current American quotations, or if more normal freight-rates were in operation so that all products could be sent to San Francisco, where refining works are contemplated to treat mixed concentrate of the character produced at Soctarie, a much improved condition would arise, possibly allowing the company to consider the erection of a more suitable milling plant to treat the Soctarie ore. However, during the present abnormal conditions all proposals of this nature have been temporarily shelved, and the company is considering the question of the bulk milling of this deposit with the means available and under the conditions existing. An agreement has been entered into with Hamilton, Beauchamp & Woodworth, of San Francisco, by which the company has obtained the right to use their process of treating tungsten ores, and it is hoped that this will prove beneficial.

Why Prices Are High

By RICHARD HOADLEY TINGLEY

"It doesn't make any difference whether you like it or whether I like it," said the banker to the depositer one morning as the latter was folding up some crisp bills that the man in the 'cage' had just handed to him. "But you know the high prices now prevailing—and they are sure to go higher if that's any consolation to you—are a necessity if we ever expect to do our part in winning this war."

"What's that got to do with our winning the war?" returned the depositor. "People tell me that prices are high because our currency is being inflated: because there is too much gold in the country: because credits are too easy: and a lot of other things. Well, I don't pretend to know whether that's right or not. I never made much of a study of such things. I do know, however, that war always brings high prices; but I can't just see what high prices have got to do with our winning the War. I should think low prices would help more than high prices. If everything was cheap we could buy more grain, and steel, and munitions, and things to send over to the other side; and more ships to send them in, too."

"Now," continued the depositor as he saw the banker was apparently interested (though he didn't suspect why), "I'm making plenty of money in my business; more, really, than I ever made before; but what good is it going to do me if I can't enjoy it and have a little more to spend? My wife has been at me for years to have some alterations made in the house, and an addition put on to the west side, and a lot of other things done about the place. It seems to her, and it seems to me, too, that we ought to be able to afford it now, but when I come to figure up the cost it fairly frightens me. If things were more reasonable in price I could afford to branch out a little, now that business is better. Of course, I bought some of those Liberty bonds. I've done my duty in helping to win the War. I sold my B. & O. bonds to get the money to do it with. I didn't want to dip into that little nest-egg I've been saving up during the past year or two since business began to pick up, for I *might* change my mind about fixing up the house. But if prices go much higher, Mr. Banker, we'll all be ruined."

The banker had listened patiently, and, as the depositor exploited his views, his jaw began to set. He knew there were men holding much the same opinions, but he had never happened to run across one of them before; he saw it was time to say something and he said it.

"Mr. Depositor," said the banker, "sit down a minute. I want to talk with you a little about these things."

"In the first place," continued the banker, "the reason why I said that high and higher prices are a necessity if we want to win this War is that, if it were not so, if prices were low, you wouldn't hesitate a minute about beginning on those alterations to your house. And if they were low enough you would do a lot of other unnecessary things, for you would feel that you could afford it. The same thing would apply to thousands of other people: to millions of other people, very likely: and what would be the result? Your surplus savings would all go into unnecessary things: into things you *can* do without just as well as not. It isn't an absolute necessity that you make those alterations in your house. You've managed to get along in it as it is so far. In times like these such an undertaking would be an unwarranted extravagance. It would take labor and materials away from useful and essential things. Practices of this kind, generally adopted, would solve this war matter very quickly: we would lose: we would fail to do the part that has been laid out for us to do. Do you see the point? How much money were you thinking of laying out on your place? $4000 or $5000? Now, suppose there were a million people who thought and figured the way you do. That would amount to $4,000,000,000 or $5,000,000,000, wouldn't it? What chance would the Government have of selling its Liberty bonds if there were a million people that went into the extravagance of spending $4000 or $5000 apiece on unnecessary improvements to their homes?"

"If prices were low a great many other extravagances would be indulged in by more millions of people and all the surplus materials would be consumed in this way. You, and a million or more other men, must get this idea firmly in your minds: we can win this war only by the exercise of thrift, savings, and economy, and by the avoidance of all extravagance. Low commodity-prices stimulate consumption at home; a thing we do not want: high prices retard consumption: a thing we *do* want and must have. Prices must be so high that you, and millions of other men, won't think of putting any alterations on your houses; not while the War lasts, at any rate."

"An inflated currency is a war necessity but it has little to do with high commodity-prices. It is also necessary that we hold onto that big gold-reserve of ours; but the mere fact that it is here has little to do with our high commodity-prices—nor has the easy-credit situation, which is said to prevail. In point of fact there is no easy credit, commercially speaking, with us now. The credit of the United States is 'easy', as it ought to be. This is the only easy-credit situation I have been able to discover. There is only one reason why prices are high. It is because the demand for labor and materials is

greater than the supply. That's the whole story in a nutshell."

"You said you bought your Liberty bonds with money obtained from the sale of your B. & O. bonds. Why did you do this? Didn't you know that, in doing so, you had reduced the Liberty bond-buying capacity of the man who took your B. & O. bonds by just the amount of money he paid you for them? That is an unsound economic theory you are working on. Suppose a million other men, or ten million other men, did the same thing: sold something of value they owned to somebody else and bought Liberty bonds with the proceeds. Would our Liberty loans be successful? You can easily see they would not. If everybody took their savings: the money they would *like* to spend for alterations on their houses, and bought Liberty bonds with it: can't you see the difference?"

"There is a right and a wrong way of doing everything," continued the banker. "It is the business of us bankers, so far as possible, to help you business men in figuring out the right way to do things from a national economic standpoint. While you people are busily engaged in solving your particular problems and in making a living, and a little more, it is our business to see to it, if we can, that you do the right thing with that little more."

"No offence, Mr. Depositor: only figure these things out for yourself and see if I'm not right. In times like these we must all work together for the best interests of the country. We cannot be selfish in war times."

"Well, come around again some day if you feel like it and I'll go a little deeper into some of these economic questions with you that I have only briefly touched on today. I might, too, tell you something about the price-fixing policy of the Government."

Somewhat dazed by the new thoughts that had been so rapidly injected into his mind the depositor rose to go. "I have never thought much about prices and why they were high, nor of Government policies" said the latter. "I never looked into and tried to reason out the 'why' of it all, but you have told me some things today that I certainly didn't know before and I want a little time to think it over quietly."

"Any time you say so, and I'm at your disposal" returned the banker, and, as he watched the depositor pass out by the lines of people in front of the 'paying' and 'receiving' wickets, he couldn't help wondering how many of their number were in the same class as the man who had just left.

THE report of the Llallagua Tin Co. of Bolivia for 1917 makes remarkable reading, says the 'American Metal Market.' The gross profit was $8,218,000, against $2,237,000 in 1916. The dividends distributed absorbed $3,060,000, while $4,080,000 was allocated to future dividends. The capital of the company is $2,040,000, the interest and dividend reserve total $4,080,000, and other reserves $2,237,000. The production of concentrate increased from 7460 long tons in 1916 to 11,250 tons last year. Stocks of ore on December 31, 1917, were 261,902 metric tons, averaging 14.33% Sn, equal to 37,544 metric tons of fine tin. Costs of production, etc., were less in 1917 than in 1916, being last year $156.80 per ton of concentrate, against $172.80 in 1916. The largest increase was shown by the Llallagua company, which ranks second as a producing company, being surpassed only by the Patino company, whose last year's output was 13,300 tons of concentrate, against 10,000 tons in 1916.

GOLD DREDGING IN THE UNITED STATES is the title of a bulletin by Charles Janin just issued by the Bureau of Mines, Department of the Interior. Mr. Janin, in his introduction, says: "The recovery of gold from sands and gravels is one of the oldest forms of mining; it antedates history and has been practised by savage peoples. In North America the search for placer gold has been a powerful agency in the exploration and development of unknown regions and has profoundly influenced the course of our civilization. With the progress of invention, the improvements in machinery, and the availability of large capital for the conduct of great operations, the tendency in placer, as in many other branches of mining, has been toward the working of extensive but comparatively low-grade deposits. The early miner washed the rich spots in stream beds or terraces with his pan, his long tom, and his primitive sluice. Then followed the growth of hydraulic mining and the use of giants supplied with water under pressures of hundreds of pounds to the square inch that could work at a profit gravels whose gold tenor was less than three cents in the cubic yard. Finally came the dredge that could handle deposits lying so far below water level as to be beyond attack by other methods. Although the gold dredge was first successful on a commercial scale in New Zealand, it has reached its present strength and efficiency in this country and its development is a monument to the daring perseverance and technical skill of the many men, mine owners, and engineers who have each contributed something to the final result. The Bureau of Mines, authorized to conduct investigations for the purpose of increasing efficiency in the mineral industries, had its attention called some years ago to the need of a comprehensive report on gold dredging in the United States. The Director of the Bureau recognized that such a report should summarize the development of the gold dredge, should describe in detail the essential features of present-day dredges, should discuss the facts that determine whether a placer deposit can be profitably dredged, and should point out the approved methods of prospecting placer ground and of operating dredges. At the request of the Director, the author undertook the preparation of such a report and this bulletin is the outcome of his labors. He hopes that it will prove of interest to designers and builders of dredges, to mining engineers, and to persons who may contemplate investing capital in placer-mining ventures." Copies of this bulletin, No. 127, may be obtained free of charge by writing to the Director of the Bureau of Mines, Washington, D. C.

Copper-Leaching by Salt Water and Sulphurous Gases

By C. S. VADNER

Copper ores are not especially soluble in a solution of salt, but a salt solution impregnated with sulphur di-oxide gas becomes a powerful solvent for the copper. Such a solution might be represented as follows:

1. $xNaCl \cdot aq + SO_2 + H_2O = (xNaCl \cdot aq)H_2SO_3$

2. Dissolving various ores:

A. Green copper carbonate, or malachite.

$$CuCO_3 \cdot Cu(OH)_2 + (xNaCl \cdot aq) + 2H_2SO_3 = 2CuSO_3(xNaCl \cdot aq) + CO_2 + 3H_2O$$

B. Blue copper carbonate, or azurite.

$$2CuCO_3 \cdot Cu(OH)_2 + (xNaCl \cdot aq) + 3H_2SO_3 = 3CuSO_3(xNaCl \cdot aq) + 4H_2O + 2CO_2$$

C. Red oxide of copper, or cuprite.

$$Cu_2O + (xNaCl \cdot aq) + H_2SO_3 = Cu_2SO_3(xNaCl \cdot aq) + H_2O$$

D. Silicate of copper, or chrysocolla.

$$CuSiO_3 \cdot 2H_2O + (xNaCl \cdot aq) + H_2SO_3 = CuSO_3(xNaCl \cdot aq) + 3H_2O$$

E. Ferrous carbonate, or spathic iron ore.

$$FeCO_3(xNaCl \cdot aq) + H_2SO_3 + H_2O = FeSO_3 \quad 3H_2O + (xNaCl \cdot aq) + CO_2$$

F. Ferric oxide, or hematite.

$$Fe_2O_3(xNaCl \cdot aq) + 3H_2SO_3 = Fe_2(SO_3)_3 \quad (xNaCl \cdot aq) + 3H_2O$$

The solution of copper ores by means of sulphurous gas and water is by no means new, but where this treatment was attempted on a large scale at one plant many years ago, failure was recorded. Five reasons were assigned as causes for the trouble:

1. The attempt to saturate the water by simply blowing the gas through it.

2. The poor agitation obtained and the consequent length of time required to leach a comparatively small amount of ore.

3. The dilute solution obtained, 1% being the maximum amount of copper which can be held in solution by an excess of SO_2.

4. The ease with which the copper separates from these solutions, both in the leaching-tanks, pressure-tanks, and filter-tanks, forming the cupro-cupric precipitate throughout the mass of leached ore, which it was impossible to re-dissolve with sulphurous acid.

5. The difficulty of treating the remaining 40% of the copper in solution as sulphate after the 60% had been precipitated on scrap iron, which was not cheaply available. Among these reasons the following appears obvious: The solvent action of the solution is hastened by the use of heat, and, at a slightly elevated temperature, well below the boiling-point of water, the resulting solution readily decomposes and precipitates the red cuproso-cupric sulphite ($Cu_2SO_3 \cdot CuSO_3 \cdot 2H_2O$) even in the mass of pulp, and when this precipitate is once formed it is practically impossible to re-dissolve it by means of a solution of sulphur di-oxide in water; the attempt seemingly would be one in which a chemical difficulty was sought to be overcome by mechanical means, resulting negatively. Again, the solvent action of such a solution on the gold and silver contained in the ores, is not sufficiently complete.

After conducting numerous experiments with a view to overcoming what seemed to be the chief difficulty it was found that the obstacle could be surmounted as follows: a common soluble chloride, such as salt or other chlorides, or a mixture of these, was discovered to be a solvent for the red precipitate formed. When used in connection with SO_2 gas and water, it prevented the formation of the precipitate. This has been covered by patent. At ordinary temperatures, no apparent action taking place between the soluble chloride and the copper solution, it appeared that the mere presence of the soluble chloride had the desired effect. Realizing that a useful application might be made of this discovery of a cheap and common solvent, acting also to prevent the precipitation of the red precipitate, numerous tests were made on various types of ore, for the purpose of determining the effectiveness of this combination, both on the copper and on the gold and silver contained. The results are given below.

The material used in the preliminary tests analyzed as follows:

	%
Copper	1.3
Lead	trace
Silica	89.7
Iron	2.2
Zinc	0.1
Sulphur	0.2
Lime	0.7
Alumina	2.3
Magnesia	0.2
Gold	0.016 oz. per ton
Silver	0.21 " " "

The material was ground to 4-mesh and treated with a salt-sulphur di-oxide solution for six hours.

Analysis of tailing

		Extraction, %
Copper, per cent	0.35	66.00
Gold, ounces	0.015	6.25
Silver, ounces	0.1	52.38

On grinding the material to 20-mesh the following result was obtained:

Analysis of tailing

		Extraction, %
Copper, per cent	0.12	88.35
Gold, ounces	0.01	37.50
Silver, ounces	0.085	60.00

By grinding the material to pass 100-mesh still better results were secured, as shown:

Analysis of tailing		Extraction, %
Copper, per cent	0.09	91.96
Gold, ounces	0.006	62.5
Silver, ounces	0.08	61.9

Comparative tests made with sulphuric acid gave no better results even when special and more expensive chloridizing agents were used. The consumption of sulphuric acid on account of bases other than copper was 36 lb. per ton of ore. The results were thought to be so encouraging that an ore of the following composition from Arizona was selected for another test. The ore was ground to pass an 80-mesh screen and assayed as follows:

	%
Copper	6.8
Lime	1.5
Iron and alumina	10.5
Insoluble	77.3
Gold	trace
Silver	"

After treating with an excess of the solvent tailing assayed:

	%
Copper	0.05
Lime	0.68
Iron and alumina	1.25

This is an extraction of 99.1% of the copper.

The excess of SO_2 gas was easily eliminated, and was available for re-use if desired; the solution was hydrolized, and then on analysis was found to contain:

	%
Copper	1.000
Iron and alumina	0.072
Lime	0.162

The specific gravity was 1.1112, and the solution was practically neutral. The analysis of the oxide of iron recovered gave 54.7% metallic iron. The recovery of iron from ores and subsequently from the solutions as above, also carried by patent, is based on the following simple and cheap reaction: When sulphur di-oxide gas acts on an iron ore, in the presence of water, the reaction illustrated by equation *E* takes place and ferrous sulphite is produced, which in turn, by means of an oxidizing agent, such as the compressed air that is used in eliminating the excess SO_2 gas, is readily oxidized to blood red ferric sulphite, thus:

G. $$2FeSO_3 + SO_2 + O = Fe_2(SO_3)_3$$

In applying compressed air to eliminate the excess acidity of the solution due to presence of SO_2, a gentle heat is applied at the same time, so that dissociation of the ferric sulphite formed occurs practically simultaneously with its formation, thus:

H. $$Fe_2(SO_3)_3 = Fe_2O_3 + 3SO_2$$

The ferric oxide and SO_2 can be recovered from the solution at almost any desired stage of the process. It is proposed to make sponge-iron from the ferric oxide thus recovered, for use in precipitating the copper from solution. This reaction is hydrolysis of the third degree, being represented by the union of a weak base (ferric oxide) and a weak acid (sulphurous acid), which are easily dissociable by cheap and common agents such as water, compressed air, and heat.

Labor Unrest in Australia

Broken Hill, the lead-silver-zinc centre, had its usual share of labor troubles during the first half of 1918, according to the annual report of the manager, W. E. Wainwright, of the Broken Hill South Silver Mining Co. These are tabulated as under:

(1) Central mine (Sulphide Corporation), night-shift strike, from March 4 to 12.
(2) Blackballing of Amalgamated Zinc concentrate dump, from March 22.
(3) Amalgamated Mines Association, embargo on raises, from April 14.
(4) Amalgamated Mines Association, embargo on winzes, from June 4.
(5) Broken Hill Proprietary, steam-shovel strike, June 14 to July 24.
(6) Junction North, strike of carpenters working among acid.
(7) Amalgamated Miners Association, fatality strikes.

Miners contracting in the South mine averaged $4.94, and helpers $4.34 per 8-hour shift. In August all the mines at Broken Hill were again closed, due to a shortage of coal, which a union at Port Pirie in South Australia refused to handle.

Dolcoath and Mount Bischoff Tin Mines

These are probably the two largest and best-known tin producers in the world. They are widely separated, Dolcoath being near Camborne, Cornwall, and Bischoff in the north-western part of Tasmania. The reports of these two companies for the first half of 1918 are just to hand, and the following data are abstracted therefrom:

	Dolcoath	Mt. Bischoff
Method of mining	Workings 3000 ft. deep	Quarrying
Ore-reserves, tons		1,185,000
Metal content, per cent.		0.29
Method of milling	16 pneumatic stamps and concentrating plant	Gravity stamps and concentrating plant
Ore dressed last half-year, tons	32,783	44,041
Metal content, lb. per ton	20	7.3
Metal produced, pounds	941,700	322,500
Grade of metal, per cent.		99.86
Cost per ton of ore	21s.11d. ($10.06)	8s. ($1.93)

Dolcoath sells its tin oxide (concentrate) to smelters in Cornwall, but Bischoff has its own smelter, which also reduces the product of other mines. On the small capital of £60,000 ($288,000) Bischoff has paid nearly $12,000,000 in dividends.

THE non-current carrying metal parts of all electrical equipment on dredges shall be effectively grounded, according to 'Safety Rules' for gold dredges, issued by the California Industrial Accident Commission. Effective grounding on a wooden boat shall consist of linking the water-pipe system and the frames of the main and swing-winches together, with a suitable metallic connector, and effective metallic connection of the part to be grounded to this system. On steel boats, grounding to the frame of the boat by bolting to it, or by other equally effective means, shall be considered effective grounding.

Mining and Calcining Magnesite in Napa, California

In Pope valley, 20 miles east of Rutherford, a four-hour trip from San Francisco, is the White Rock magnesite mine. Napa county last year contributed 19% (40,218 tons) of the total (211,663 tons) of crude magnesite mined in California. The principal producer in the county was the White Rock, controlled by Frank R. Sweasey of San Francisco. The road to the property is picturesque, following Chiles creek most of the way. The mine is at an elevation of 1200 ft., and 500 ft. above the calcining-plant.

The main vein—for it is such, with distinct walls—is in serpentine, dipping 35°, whereas the orebody pitches north-west. From a 500-ft. tunnel, 200 ft. of which is used as the main outlet of the mine, are drifts that have developed, so far, 450 ft. of ore. Above these are five levels, showing 350 ft. of backs above the tunnel-level.

WHITE ROCK MAGNESITE MINE, POPE VALLEY, NAPA COUNTY, CALIFORNIA

TRAM TERMINAL, CALCINING-PLANT, AND ORE-BINS AT WHITE ROCK MAGNESITE MINE

Ore persists below. All broken ore passes down chutes to the adit. In the main vein there is an average of 15 ft. of ore; a parallel vein, east of the main orebody, opened for 40 ft., shows a 15-ft. face, and is most promising. Some open-cut work has been done on this new ore-shoot. The stopes in the main vein are filled, pillars being left to support the ground; but eventually these will be extracted, allowing the hanging wall to cave. Two Chicago Pneumatic company's compressors, each driven by a distillate engine (semi-Diesel), supply air to an average of 10 stopers and jack-hammer drills. Inclusive of engine-men, blacksmith, etc., 65 men are employed at the mine, which is in charge of Arthur Deleray, with William Lewis as foreman.

From the outlet of the mine the ore is run over a two-inch grizzley. The oversize goes direct to the kilns. The undersize, carried to the tram-terminal, goes through a revolving trommel with 1¼-in. perforations. The oversize is fed into the kilns, while the undersize is dropped onto a 1¼-in. shaking wire-screen. What passes through is discarded at present, being high in silica.

Between the mine and the calcining-plant, a distance of 5000 ft., with a 500-ft. fall, is an aerial tram. This has given satisfactory service. It is partly a gravity machine, but is helped by a 7-hp. gasoline engine. It carries sixteen 1000-lb. buckets, and has a capacity of 20 tons per hour. Three men take care of this tram. Besides carrying ore, it takes some supplies to the mine. The cost of operation is from 10 to 12 cents per ton.

An average analysis of the crude ore is as follows:

	%
Silica (SiO_2)	1.94
Iron oxide (FeO)	1.49
Lime (CaO)	0.67
Magnesia (MgO)	45.01
Carbon di-oxide (CO_2)	50.65
Total	99.76

The lime is frequently less than the percentage quoted; the iron more, up to 2.5%. The calcining-plant consists of 11 vertical kilns, all 24 ft. high, with 35-ft. stacks. Five of these are of 5½ ft. diameter; they have steel jackets, lined with 13 in. of firebrick. Three others have an inside diameter of 6½ ft.; while the remaining three are 6 ft. in diameter; these are of brick, 18 in. thick, strengthened by steel bands.

Alternate layers of coke and magnesite, in the proportion of 1:12, are dumped into the kilns from the feed-floor. Coke, from Alabama and Tennessee, is used. Natural draft is sufficient to 'burn' the ore in 24 hours, that is, for the crude ore to pass through the kilns. Their capacity is 6 to 7 tons each of calcined ore per day, containing about 0.50% CO_2. The ore is fairly cool when drawn off. At the bottom of each kiln are four discharge-doors, which feed ore-cars running on a track on both sides of the kilns. The ore is either dumped directly into one bin or crushed, elevated, and put into another bin, as desired by the consumer. Twenty-five men are employed at the plant, which is in charge of Joseph Rose. A laboratory is maintained for analyzing crude and calcined ore. At both the mine and plant, camps are maintained for employees.

An average analysis of the 'burned' ore is given below:

	%
Silica	4.60
Iron and alumina	4.46
Lime	none
Magnesium oxide	90.46
Ignition loss	0.48
Total	100.00

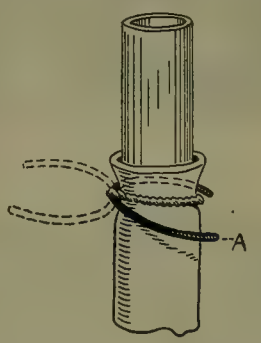
The high iron content of this ore makes it desirable for refractory purposes, such as the lining of steel-furnaces, and is used both in the East and on the Pacific Coast.

From the calcine-bunkers the ore is carried to rail at Rutherford in 5-ton White and Packard auto-trucks. Two round trips can be made in 10 hours. The monthly output of the mine is 3500 tons of crude magnesite, or 1750 tons of calcined product.

Connecting Glass and Rubber Tubing

By C. C. KIPLINGER

In gas analysis, trouble is experienced frequently in the attempt to make tight connctions between glass and rubber tubing. Experience has shown that this is accomplished best by wrapping a single turn of wire about the joint and twisting tightly. However, there are two objections to this method. The wire tends, if twisted tightly,



to cut the rubber, and if the rubber tubing is appreciably over-size, the tubing is compressed or pinched near the twisted portion of the wire, frequently making a small channel through which leakage occurs. The device herewith described overcomes these difficulties, permits the use of over-size rubber tubing, and insures joints that are gas-tight and water-tight. It has been used throughout the year with Liebig condensers and gas apparatus and has given complete satisfaction. *A* is a piece of stout wire bent in U-form of such size that the limbs of the U will just slip over both tubes. A loop of stout cord is tied about the connection, the wire U is slipped through this loop, as shown in dotted lines, the cord now twisted, using the wire as a lever, and, as soon as the joint is tight, the U is turned as shown at *A*. Cord is better than the usual copper wire for this purpose, in that the former distributes the force more uniformly throughout its length. A further advantage of this mode of attachment lies in the ease with which it may be dismantled, requiring, as it does, no pliers or other tools for this purpose.—'Jour. Ind. & Eng. Chem.'

REVIEW OF MINING

CHICAGO, ILLINOIS

Meeting of the American Bankers' Association.—Resolution Asking the Government to Sustain the Gold Industry.

The annual convention of the American Bankers' Association assembled here on Monday, September 23. Over 4000 out of the total membership of 19,000 throughout the country, were in attendance. This is a larger proportion than ordinarily responds to the call for these periodic meetings. The unusual circumstances of war have brought into existence new problems and new difficulties, and these considerations have increased the national interest in the work of the Association. Representatives from all departments of the Government were present, and Secretary Daniels arrived on Friday morning. George E. Chamberlain, chairman of the Committee on Military Affairs of the U. S. Senate, addressed the convention on 'Universal Military Training and Compulsory Service.' Harry A. Wheeler, president of the Chamber of Commerce of the United States, spoke on 'The Merchant Marine and the Railroads.' Of special interest to the mining world was the action taken on Friday concerning the need of stimulating the declining gold industry. This was an extension of the views expressed by the Pacific Coast Bankers' Gold Conference at Portland, Oregon, on September 5, at which the leadership of A. L. Mills, E. G. Crawford, John Clausen, and H. N. Lawrie resulted in a flat declaration for relief to the gold miners for the sake of adding to our gold reserve. At Chicago, Messrs. Mills, Crawford, and Eugene Davis were especially active in presenting the case for the gold industry, and with the support of large financiers close to the ear of the Treasury officials the following resolutions were adopted:

Whereas, the gold production of the world is rapidly decreasing, and

Whereas, the only form of relief that will prove effective and can be applied promptly is action by the United States government in such form and by such method as may be deemed fit and proper under the circumstances, and

Whereas, gold is the standard of value and the basis of all credit, and is of vital importance to the financial and commercial life of the Nation and of the world; now, therefore, be it

Resolved, That the American Bankers' Association in convention assembled respectfully requests and urges upon this Government of the United States the desirability of maintaining the production of gold to at least its pre-war volume, and asks that steps be taken immediately to that end; and be it further

Resolved, That the secretary of this Association be and he hereby is instructed to send a copy of this resolution to the President of the United States, the Secretary of the Treasury, and the Secretary of the Interior, advising them of its adoption; and be it also further

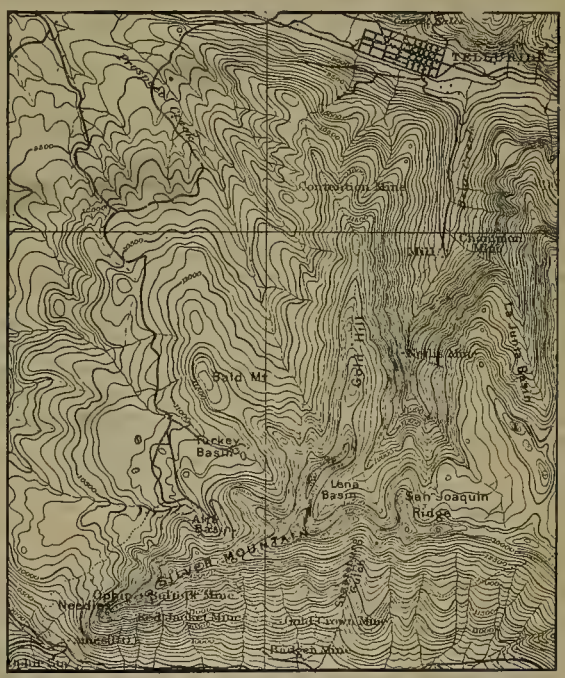
Resolved, that considering the great importance of this subject, this Convention recommends to the Executive Council that the matter be referred to the Federal Legislative Committee and the Currency Commission for exhaustive study and such action as may be deemed necessary.

As affecting the gold industry, the main features of the Bankers' convention may be briefly summed up as follows: There was a surprising lack of information with reference to the condition against which the gold-mining industry now is contending; also there was a lack of general interest in the subject; and finally there was suspicion of any proposal for relief emanating from the gold miners. Nevertheless, the endorsement of the Western bankers, and the presentation of figures revealing the dangers threatening the continuance of gold production, resulted in a declaration in favor of Federal investigation and action.

DURANGO, COLORADO

Review of the La Plata, Ouray, Red Mountain, Rico, Silverton, and Telluride Districts.

Telluride.—Among the most interesting news of this district is the purchase of a share in the Carbonero by the Tomboy Gold Mines Co., formerly owned by George Pickett.



TELLURIDE DISTRICT, COLORADO. THE PROPERTIES AND NEW MILL OF THE BELMONT-WAGNER ARE IN THE ALTA DISTRICT. (U. S. G. S.)

It is expected that the Carbonero will develop into one of the best producers in the Ophir district, as the ore carries iron and copper, also other metals in payable quantity. Part of the workings have been sub-leased to Ruuttila-Brown Leasing Co., which is shipping ore. D. A. Herron, of the Tomboy company, estimates an output of over 100 tons per month of shipping ore.

The Tomboy company has increased the wage-scale by 50c. per day.

The Belmont-Wagner company is now dispatching over four cars of concentrate per week. At present the only hindrance is the shortage of cars to carry concentrate to the smelter. Among the difficulties encountered by the Belmont-Wagner company were the necessity of splitting in two, and subsequently welding together of the huge compressor, in order to transport it over the steep and poor road leading to the mill. When the mill was starting, the grinding department was a prolific source of trouble, and a small mill was converted into a re-grinding unit. The Marcy mill has been re-built. After the mill was running for a short while, it was discovered that the diaphragm-pumps failed to lift the concentrate from the thickener-tanks to the filter, so that it was necessary to put in a wet elevator. At present all difficulties seem to have been overcome, and the recovery has been gratifying. The ratio of concentration is 12:1, and from 15 to 18 tons of concentrate is produced daily.

La Plata.—There is little mining activity in the La Plata. Prospecting is not being carried on to any great extent. Present costs of operating preclude the possibility of making profits from any but high-grade gold and silver ores. A bonus on gold would be a great help to this region.

The Valley View Consolidated Gold Mining Co. continues to operate, and ships one car of ore monthly. Extensive development is being carried on.

Owners of the Durango Girl recently sent out ore that carried over 60 oz. of gold per ton. They generally make a similar small shipment each year.

Ouray.—Mining is quiet, owing to the light demand for silicious ores and the heavy operating and transportation charges.

The Ouray Consolidated M. & M. Co. has acquired the National Bell, and will develop as soon as the Treasury tunnel is in condition.

Red Mountain.—Although great difficulty has been experienced in securing labor, in spite of a wage of $5 per day, extensive development and ore shipments are being made. Labor difficulties have been partly obviated by sub-leasing, whereby the miners can make better than wages. By this system some properties are producing heavily, especially the Congress Leasing Co.——The Kapegi Leasing Co. has been tied-up by litigation, in which one of the members of the firm has become involved. A large quantity of ore that had been shipped was awaiting delivery and settlement; but the proceeds were attached, leaving the operators short of capital, so that the work will probably be at a standstill until the difficulty is settled. The new orebodies recently opened average 12% copper.

P. W. Clark & Co. are working over the Yankee Girl dump, under a sub-lease from the Red Mountain Mines Co. They expect to ship 600 tons during the season.

Rico.—Now that the scale of pay prevailing in the Silverton and Telluride districts has been adopted in the Rico district it is expected that ore production will be greatly increased. During August there was dispatched 23 cars of ore, 14 by the Marmatite, 8 by the Rico-Argentine, and 1 by the Rico Wellington.

Silverton.—Many new names are being added to the shipping list this season. The high cost of labor and supplies have handicapped the smaller operators. The San Juan is receiving attention from outside capital.

The Henrietta Copper M. & M. Co., newly organized, is overhauling all of the Henrietta properties in the Gladstone region, and is now ready to ship. Under the direction of Mr. Kendricks of Denver sufficient capital has been secured to pay all indebtedness and to carry on development.

The Caledonian M. & M. Co. has its extensive development campaign about completed. During the past two years the operators have expended large sums of money in preparing the mine for steady production. This is satisfactory to all interested here. The new 75-ton mill is in operation. Among the equipment is a Samson crusher, triplex rolls, a ball-mill, a Hyde flotation machine, and four Wilfley tables. For the present the mine and mill are working one shift. G. A. MacKenzie is in charge.

The new tram terminal of the Silver Ledge company has been completed, and a large quantity of ore has been moved, 300 tons having been concentrated at the North Star mill. This company has been handicapped by considerable litigation over royalties and milling concessions, in addition to sustaining heavy losses by the fire that destroyed the mill last August.

Some interesting facts regarding the recent sale of the Gold King mines are as follows: The property known as the Gold King consists of over 150 acres of patented ground. The properties known as the Gold King Extension Mines Co. have an area of 55 acres extending between the Gold King and Sunnyside properties, so that the total holdings of the new company will be 205 acres. Officers are: president, Herbert S. Hadley, of the State University at Boulder; J. N. Nicholson and Rufus G. Gentry, vice-presidents; G. W. Kinney, treasurer; G. Dexter Blount, secretary; board of directors, Addison J. MacCune, F. D. Stackhouse, O. B. Haley, S. L. Moe, John Fleming, of the Law School at Boulder, and W. Z. Kinney. The rumored price is around $5,000,000. Among the equipment is a 300-ton flotation mill.

Interesting work has been that of Anderson & Holmgren on the Veta Madre. Although the old workings had not been re-timbered, or cleared for many years, the operators cleared out the workings and timbered so quickly that they are now starting to ship ore.

Mears & Wilfley have been concentrating a much higher grade of tailing from Silver Lake basin. Present shipments of concentrate carry over 1 oz. gold, and 10% copper.

The Sunnyside M. & M. Co. is shipping concentrate at the rate of about 20 cars per week.

The Red Mountain Mines Co. is shipping some crude ore from its holdings and from sub-lessees. Ore is now being dressed by the North Star mill at Silverton; concentrate contains over 50% lead, also high value in other metals. Zinc concentrate is shipped to Florence.

HOUGHTON, MICHIGAN

Effect of Labor Shortage.—Cave at Centennial.—Diamond-Drilling by Copper Range.

Suspension of work at the Houghton mine makes the tenth exploratory property to be closed in this district since the beginning of the War.

The old workings of No. 2 Centennial caved to the first level last week, making a hole at the surface 50 ft. in diameter and 30 ft. deep. The shaft has an angle of 40°, and there is little danger of any further caving. This shaft produced 500 tons of ore daily, so there may be a temporary interference with production.

Franklin continues to send ore to the mill at the rate of 800 tons daily, also continues to pay 20c. per ton for haulage, against 10c. paid by the Hancock. The Government has this situation under advisement, but has made no adjustment as yet. Franklin employs 250 men.

Wolverine's mill is working two shifts, concentrating 800 tons daily, while its capacity is 1400 tons. This is one result of the labor shortage.

Mohawk keeps three stamps dropping, mostly full time. The shaft at the mill is down 50 ft. The tunnel from this shaft, when bottomed, will extend half a mile under the lake.

Copper Range continues diamond-drill work at the Challenge property, 1½ miles south of the Champion mine. The seventh diamond-drill hole is now down 300 ft. This work is for geologic investigation. Some of the cores have

carried copper. The mines of this company—Champion, Trimountain, and Baltic—are producing 35% of normal; and there is no hope of any improvement.

Quincy has raised wages, making a minimum of $4.80 per shift, plus a bonus of 15c. for men who do not lose a shift between pay-days.

Allouez has added another trolley locomotive for underground tramming. Three more of the storage-battery type are to be ordered.

It has been mentioned in these notes that many men were going to Detroit, attracted by visions of high pay at munition factories; they have been disillusioned and are starting to return to the Copper Country. Rent here is from $4 to $8 per month, living in company houses; at Detroit a similar house costs $45.

COBALT, ONTARIO

Professional Ethics and General Development in the District. —Larder and Kirkland Lake Areas.

A case recently tried by Mr. Atkinson, police magistrate, at Cobalt, involved a somewhat important question as to the respective rights of mining engineers and surveyors. M. P. MacDonald, an engineer, was charged with infraction of the Ontario Land Surveyor's Act by doing underground surveying for Cobalt mining companies. Under the Act, the surveyors are the authorized technical body for making surveys for recording purposes, but it was contended that MacDonald was entirely within his rights in doing mine surveying on properties of which the boundaries had been recorded. This is a common practice at Cobalt. The Court upheld this view, and dismissed the case. A contrary decision would have entailed the necessity of re-surveying the workings of many properties.

The Kerr Lake closed its most profitable year on August 31. Its output for the period was over 2,575,000 ounces.

The Nipissing company states that development has been somewhat hampered on account of the part destruction of the aerial tram connecting No. 73 shaft with the low-grade mill.

The Mining Corporation is pumping sand and slime from the bed of Cobalt lake at the rate of 1000 tons daily, and treating 300 tons, stacking the remainder for treatment during the winter.

The recent discovery of high-grade and milling ore at the 350-ft. level of the Violet mine of La Rose is regarded as of more than ordinary importance. The ore-bearing zone is in Keewatin formation, about 20 ft. above the diabase contact, which has a considerable dip to the east, making the probable ore-bearing area of considerable size. An entirely new vien has been uncovered on the 330-ft. level.

Larder Lake.—Little has been heard recently about the Larder Lake district, owing to its distance from rail. One company appears to be making good. The Associated Goldfields, which has 2000 acres, is steadily developing with 30 men. At the 500-ft. level, a cross-cut on a large orebody has been driven 60 ft. in ore; while on the 100-ft. level, in another section, a drift on a wide vein has been driven 100 ft., with ore still in the face. It assays $32 per ton.

Kirkland Lake.—The purchase of the Orr property by the Kirkland Porphyry, which has worked it for a year under option, has been completed. The price was about $500,000 of which $100,000 was paid and security given for the balance.

At the Elliott Kirkland, diamond-drilling is being carried on from the 500-ft. level to determine the trend and extent of the rock formations.

The Burnside, which has lately found a good deal of high-grade ore, has completed arrangements for the erection of a small mill.

Boston Creek.—Another rich discovery of gold has been made on claims owned by James Hughes and Thomas Middleton, of Haileybury, lying adjacent to the Miller Independence. C. B. Flynn, of New York, and associates have obtained an option on the property at a high figure.

The shaft of the Miller Independence is down 200 ft. and the work of cross-cutting the vein at that level has commenced. The rich ore found at the surface persists to the present depth.

VICTORIA, BRITISH COLUMBIA

Platinum, Fluorspar, Iron, and Dividends.

There is a prospect that the Peace River country, a large area in the extreme north-east of this Province, will become a platinum producer. A syndicate, at the head of which are W. L. Hartman of Detroit and L. Bright of Chicago, is reported to have secured control of extensive placer ground to which will be shipped this fall two large Keystone drills and a modern dredge, with a capacity of 100,000 cu. yd. of gravel per month. Prospecting is said to have proved the presence of both platinum and gold in payable quantities.

When the Hon. William Sloan, Minister of Mines, accompanied by J. E. Thompson, member for Grand Forks in the Provincial legislature, was making an inspection of the plant of the Consolidated Mining & Smelting Co. at Trail just about a year ago, he was told of the hydro-fluosilicic-acid problem. It was pointed out that the fluorspar necessary in its manufacture had to be imported from Kentucky, a distance of from 1500 to 2000 miles. This made the cost so high that the discovery in this Province of such a deposit was a matter of importance. The company has since bonded claims known as the Rock Candy group, on the north fork of the Kettle river, above Grand Forks. Since acquiring control, much development has been done, a car of ore having been loaded for Trail. No time was lost in putting the property on a producing basis, and in view of the difficulties that had to be overcome the work accomplished in a short time is worthy of note. The company first had to build a trail, over which supplies and equipment, including a diamond-drill outfit, had to be packed in on horses. On the return trips the horses brought out ore, so that the company could get a car for testing purposes at an early date. A right-of-way had been cut through for a new wagon-road, toward the construction of which the Mines Department is assisting, and before winter the mines are expected to make regular shipments.

A rich development is reported from the Lanark mine, Illecillewaet, one of the oldest mines of the Province. One ore-shoot has been opened for 350 ft., without its limits. There is 14 in. of 50 to 70% lead and 40 to 100 oz. silver ore, and 4 to 5 ft. of concentrating ore carrying 20 to 25% lead. Forty thousand dollars worth of machinery is being erected.

The Ladysmith Smelting Corporation has again ceased operations at Ladysmith. Its smelter was run for a short time, when an accumulation of ore was disposed of. It is understood that the options it had taken on a number of mining properties in order to assure a constant supply of ore for the smelter will be allowed to lapse.

Dividends declared by the principal mining corporations in the first eight months of the current year are as follows:

Company	Amount
Granby Consolidated	$1,124,886
Consolidated M. & S.	523,872
Hedley Gold	72,000
Britannia M. & S.	198,415

If the smelter tests prove favorable, immediate development of considerable deposits of bog iron, situated on the mainland of British Columbia and near the Pacific Great Eastern railway, is promised by the operators of the Irondale, Washington, foundries.

THE MINING SUMMARY

ALASKA

Juneau.—Telegraphic reports state that on September 26 the heavy rainfall had caused much damage in this district, resulting in suspension of generation of power and mining operations.

ARIZONA

Benson.—Los Conquistadores Mining Co. has been organized and is selling shares to operate a gold mine 14 miles north of this place. There has been some development done on the property.

Bisbee.—Shattuck-Arizona produced 682,861 lb. of copper, 199,528 lb. of lead, 14,189 oz. of silver, and 113 oz. of gold in August. The copper output is still below the normal of over 800,000 lb. The lead is always irregular.

Calumet & Arizona produced 4,376,000 lb. in August, about a normal yield.

Duncan.—The Maple-Lissa Syndicate, which is operating the Phillips fluorspar property, 10 miles north-east of Duncan, has shipped its second car of spar. Ten men are now employed.

Another syndicate of local men is opening fluorspar in the vicinity of the Phillips property.

Shipments of manganese will commence shortly from two recently opened mines at Cap mountain, south-east of Duncan.

Jerome.—United Verde Extension pays 75c. per share on November 13. This amounts to $1,125,000.

Shipments were started from the Jerome Verde on September 17 to the smelter at Humboldt. There are 60 tons of ore in bins and as much more broken in the stope. Extraction is being made from the fourth floor above the 900-ft. level of the Maintop claim.

Five headings are being driven in the Pittsburg-Jerome, four on the 500-ft. and one on the 900-ft. level. The crosscut on the latter has shown nothing of note.

The Dorothy May shaft of the Green Monster is in 990 ft.

The diamond-drill work at the Calumet & Jerome has been practically completed. Some good-looking ground was cut, but nothing of importance was exposed. The management has made no announcement as to future plans, but it is probable that future development will depend largely on conditions exposed in the neighboring Verde Combination and Gadsden properties.

Metcalf.—The Shannon Copper Co. produced 708,000 lb. during August. This is a decrease of 86,000 lb. when compared with July.

Wenden.—The Black Reef Copper Co. states that it has decided to close its mine until after the War. When work is resumed, exploration will be done by diamond-drilling from the 500-ft. level. The property is 9 miles north of Wenden, in Cunningham pass.

ARKANSAS

Batesville.—A detailed examination of the manganese deposits of this region has recently been made by H. D. Miser of the U. S. Geological Survey, which has issued a preliminary report. The developed deposits lie in a belt 20 miles long by 4 to 8 miles wide, extending north-east through Independence, Sharp, and Izard counties. Mr. Miser visited 180 mines and prospects, most of which have produced ore. The output from 1850 to 1917, inclusive, was 65,261 tons, plus 61,330 tons of manganiferous-iron ore. Only 11 mines have yielded over 1000 tons of ore. The Southern mine contributed 36,000 tons to the total. The ores are chiefly the oxides psilomelane and braunite. Some wad and manganite also are minable. All classes of ore are found in the Cason shale and in the underlying Fernvale limestone. Rock changes resulted in the ores being in the residual clays of these formations. These clays

PART OF ARKANSAS, SHOWING POSITION OF MANGANESE AREA.

contain ore in ratio ranging from 3 of clay to 1 of ore to 35:1. The best ore contains 45 to 52% Mn; some up to 60%. Most carry 3 to 8% iron, 0.15 to 0.30% phosphorus, and 2 to 8% silica. The ferruginous ore carries 20 to 40% Mn, 8 to 20% Fe, and 5 to 26% SiO_2. Three grades are made, sorting being done by hand. Estimates of reserves show at least 250,000 tons of 40% and 170,000 tons of less than 40% Mn ore. No shafts are deeper than 132 ft. Drifts must be well timbered. Windlasses or horse 'whips' are used. There is plenty of timber available, also water. Wages are from $2.50 to $3 per day. Mining costs are as high as $28 per ton of high-grade ore. Transportation facilities are lacking, and a large portion of the ore has to be hauled 7 to 10 miles. Unless present crude methods and high costs are improved, the industry cannot thrive or meet lower prices for ore. The manganese is used for making ferro, spiegel, and pig-iron.

CALIFORNIA

San Francisco.—On September 30, H. G. Butler, State Power Administrator, removed all restrictions on the use of power by gold dredges. This is effective for 30 days, but will be re-imposed if there is no more rain in the mountains. Gold mining and power are referred to editorially in this issue.

Grass Valley.—The Allison Ranch mine has been unwatered to the 900-ft. level, and development of ground above this is progressing.

It is stated that G. W. Root has made arrangements to finance the re-opening of the Kenosha mine, owned by the Alcade Gold Mines Co. The main shaft is 450 ft. deep. There is a good electrically-driven plant ready.

Keswick.—Completion of the Mountain Copper Co.'s enlarged flotation plant at Minnesota station on the Iron Mountain railroad is greatly delayed by the inability to get machinery as ordered.

Knob.—The chrome mines on Beegum creek, a few miles from this place, have been shut-down for the winter. There are 700 tons of ore waiting to be hauled, and that is all the trucks can carry to the railroad at Redding before next spring.

McCloud.—Twelve carloads of pumice, from Pumice mountain, 28 miles from Bartle, have been shipped East this season. The claim belongs to C. M. Depew of San Francisco. The mountain is 7000 ft. high, and appears to be all pumice. The material has to be trucked 9 miles to the end of a lumber railroad. Experiments are being made in using the pumice in concrete work—such as floors—where lightness would be of advantage.

Redding.—Charles H. Spinks is developing 13 asbestos claims on Mears creek, west of Hazel Creek post-office. The property is the subject of litigation.

Weaverville.—The 40-stamp mill at the Fairview mine, near Minersville, is being dismantled and hauled to Redding for shipment to San Francisco. The mill has stood idle for 18 years. There is nearly 100 tons of iron and steel in the lot. There is no hoist as the Fairview was opened by tunnels.

COLORADO

Breckenridge.—The Tonopah Placers Co. has been churn-drilling some ground south of town, and may erect another dredge.

Cripple Creek.—The Portland company is dismantling the shaft-house at the Independence mine to allow of adding 30 ft. to the head-frame. A 5-ton automatic-dump skip is to be used. These improvements will enable a large quantity of ore being treated in the Independence mill.

The Big Toad M. & M. Co., leasing at the Dante mine, has re-modeled the Reid mill of 100 tons capacity, and is to start treatment of ore this month.

Leadville.—A concentration process for low-grade manganese is said to have been devised by C. E. Wuensch of the Yak company, who recently described it to a meeting of local men. For thorough testing he is asking them for assistance.

Ouray.—As is now well known, the Mountain Top company has a mill underground. At present, dumps on the surface are being taken into the mine, crushed, and treated by flotation. Twenty men are employed.

IDAHO

Mullan.—The Federal M. & S. Co.'s Morning mine has resumed work, after repairs to main shaft. This company's ore production is just half what it was a year ago, when it was nearly 12,000 tons per month. The report for the second quarter of 1918 shows a profit of $323,309, against $63,945 and $836,821 in the two previous periods.

Prichard.—Awaiting transportation from the railway here is a 4 by 4 by 50-ft. steel spud for the Yukon Gold Co.'s dredge on Prichard creek, near Murray. The spud weighs 20 tons, and is to replace a broken one on the boat. A caterpillar-tractor and trucks will be used to haul the structure.

MICHIGAN

Houghton.—The August output of ore from the Champion mine was 45,800 tons, from the Trimountain 16,000 tons, and from the Baltic 28,000 tons. These low figures are not to be wondered at considering the difficulty of securing men.

The only mine in the district that continues to show a steady increase in ore tonnage is the Isle Royale. The mine is furnishing all the ore that can be handled at its own mill, at Houghton, where three stamps are working three shifts, including Sundays. Last week the Isle Royale increased its shipments to the Point Hills plant—in which it owns a joint interest with other Calumet & Hecla subsidiaries—from 75 to 119 cars, so that the output for this month will be better than normal, all things being equal.

Calumet & Hecla and subsidiaries increased wages to all employees from 10 to 30% on October 1. The lowest wage underground is now $5 per day.

MISSOURI

Joplin.—It is estimated that there is 18,000 tons of zinc concentrate in reserve in the district, this not being thought excessive when all conditions are considered.

Production of the Tri-State region last week was 7184 tons of blende, 518 tons of calamine, and 1396 tons of lead. These averaged $53, $38, and $100 per ton, respectively. The total value was $543,690, of which Missouri contributed $130,626.

The Freehold Oil & Gas Co. has purchased two developed leases in the Waco-Lawton field, and will erect a 200-ton mill on each. W. S. Marquiss of Webb City is manager.

MONTANA

Butte.—Anaconda will pay $2 per share on November 25. This is equal to $4,622,500.

Clancy.—Re-timbering of the old 500-ft. shaft of the Legal Tender mine is under way. This was a former producer of high-grade silver ore.

The Amalgamated Silver Mines is mining and shipping high-grade silver ore from Free Coinage ground.

Corbin.—At the Alta mines old workings beneath Alta hill are being unwatered. A new transformer has replaced the Bertha plant, destroyed by lightning.

Philipsburg.—The Butte & Plutus company has acquired a half interest in the Jack Knife claims, near here. The Redemption claim has yielded manganese worth $80,000 during the past 18 months. The ore-bed carries from 19 to 40% Mn.

Saltese.—The Richmond M., M. & R. Co. pays a dividend of 1c. per share, $8400, on October 20. The last dividend was in November 1917. This copper mine gives promise of producing a good deal of high-grade ore.

NEVADA

Las Vegas.—The Las Vegas & Tonopah Railway, between Las Vegas and Beatty, is to be torn up, according to announcement of the Nevada Railroad Commission. The road was built to Beatty during the Goldfield boom. The company claims that the action of the U. S. Railroad Administration in routing all freight over the Tonopah & Tidewater railroad, which is 100 miles shorter, makes operation of its line unprofitable.

Luning.—Leading mine-owners of the Luning and Mina districts are to meet at Reno on October 10 to discuss the proposal to erect a smelter at one of the two centres. The ores carry copper, gold, and silver.

Manhattan.—The White Caps Mining Co.'s report for the year ended April 30, 1918, is considered disappointing. Sales of gold realized $110,254, while expenses totaled $269,111. These included $14,730 for apex litigation, $25,000 for depreciation, and $26,809 for administration. The

cost of mining and milling was $200,000. Current liabilities were $181,918, and assets $107,905, on April 30. The profit in May, June, and July, 1918, was $8371, $1339, and $6676, respectively. Monthly expenses are now $21,500. Regarding the mine, it is stated that while previous sampling gave an average of $20 per ton, the ore so far treated only averaged $13. As the orebodies consist of irregular chimneys in limestone, no estimate can be made of reserves; but they are continuous from surface to 550 ft., and show indications of persistence. The gold output in May was $30,352, in June $22,715, and in July $28,473. The quantity of ore treated in the period under review was apparently 8480 tons.

The White Caps company is levying an assessment of 3c. per share, equal to $48,000.

Tonopah.—Production of some of the mines in August was as under:

Mine	Tons	Silver, oz.	Gold, oz.	Profit
Belmont	8,413	99,864	1031	$50,812
Extension	9,027	105,679	974	37,176
Jim Butler	1,463	.....	....	29,813
Tonopah Mining	16,700	108,420	1047	38,335

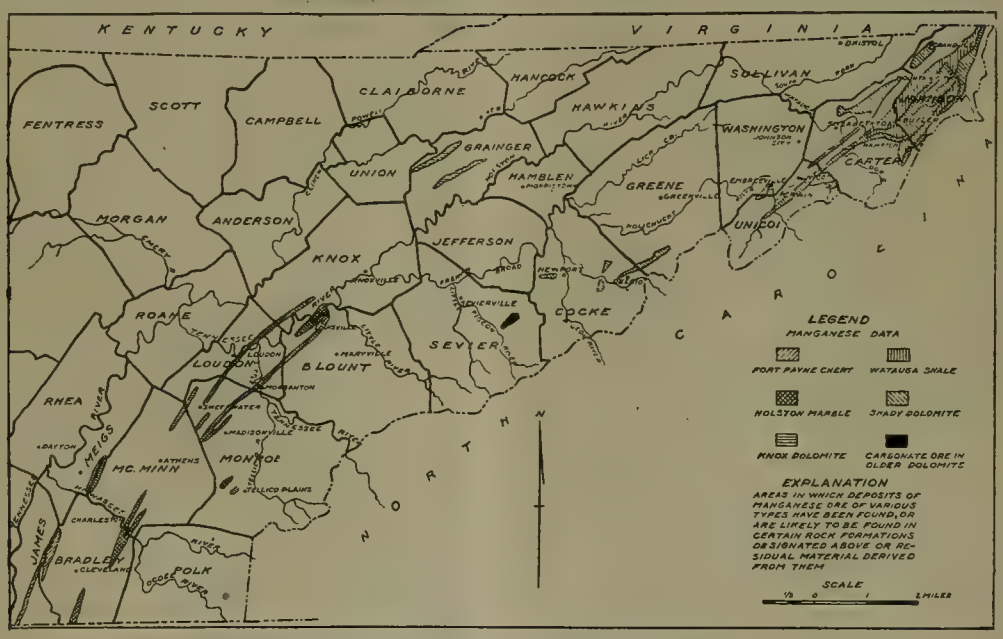
OKLAHOMA

Picher.—Production of the districts last week was 4741 tons of blende and 924 tons of lead, valued at $359,414.

The Premier mine here is an example of a good producer. In August, the mill working one shift daily, produced 385 tons of lead concentrate (about 80% metal), and 520 tons of zinc concentrate (about 60% metal). The total value was approximately $63,000. A. M. Gaines is manager.

TENNESSEE

Nashville.—In 'The Resources of Tennessee' for July, G. W. Stose and F. G. Schrader, of the U. S. Geological Survey, discuss the manganese deposits of eastern Tennessee. The report (Part I) covers 56 pages. The field work was done in co-operation with the State Geological Survey. The region examined is partly mountainous, partly lowland. Most of the known manganese deposits consist of heavy, black, hard minerals somewhat resembling iron ore in appearance and occurrence. They are frequently called black iron ore by farmers. The minerals are the oxides. They are found commonly in small masses in the soil and underlying clay, where they are discovered in plowing, in road cuts, or as float. Within the clay the ore is irregularly scattered as minute particles or the size of a bushel basket, occurring as botryoidal masses, or rounded nodules. The ore in the clay must be washed. Some of the masses are large enough to be mined as lump ore, and are shipped without washing. Other masses fill seams in sandstone and chert, necessitating crushing the rock and separating the ore by log-washer, etc. A list is given of the prospects and mines in the region, some of which are described.



EASTERN TENNESSEE, SHOWING MANGANESE DEPOSITS.

MEXICO

Chihuahua

Parral.—Confirmation of the reported destruction of two troop trains and a large steel bridge on the Parral and Durango railroad by Villa forces on September 16, was received at El Paso, Texas, on September 24. The trains left Parral on the morning of Independence Day, carrying 700 infantry, followed by cavalry supports. At San Jose, 60 kilometres from Parral, the steel bridge was dynamited and 10 of the 20 cars making up the two trains were burned. As nothing was said about casualties among the troops it is believed they had detrained for the mountains in pursuit of Villa. The damage to the railroad was $100,000. Rumors that Villa captured Parral September 20 were denied by messages from there on the 24th. His forces attempted to take Jimenez on that day, but failed. General Amaro arrived at Parral on the 20th with a cavalry column, marching from Durango. Americans at San Francisco del Oro, Durango, employed by the San Francisco mines of Mexico, a British corporation, were forced to leave for Parral on the 16th to escape Villa raiders. General Amaro is now in pursuit of the Villa band in the Parral-Jimenez district.

Doubling back on his trail Villa and 80 men entered and held Jimenez, Chihuahua, on Sunday, the 22nd, looting the town and killing 60 soldiers and civilians. Among those reported killed were all the members of the Gonzales family, against whom Villa had a grudge because he claimed they attempted to poison him two years ago. The body of a Mexican Central railroad official, who was killed in his house during the fighting, was brought to Juarez.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

W. Tovote is at Tucson.

Henry C. Perkins is here.

C. B. Lakenan was at Palo Alto this week.

William Sharp, of Goldfield, Nevada, has joined the Army.

J. M. Callow was in San Francisco during the early part of the week.

Archibald Burnett, recently at Swansea, Arizona, is in San Francisco.

L. F. S. Holland has been at Mexico City and is returning to Los Angeles.

Rene de Sallier has moved from Basin, Montana, to Watertown, New York.

R. Skewes Saunders, manager of the Dos Estrellas mine at El Oro, is in London.

H. Huntington Miller is at La Colorada, in Sonora, Mexico, on professional business.

W. D. O'Brien has gone to Washington, on his way to Bolivia on Government work.

L. N. V. Bullock is a Captain and a D.S.O. in the British contingent on the Italian front.

W. S. Lecky is doing good work as superintendent for the War Purchasing Commission of Canada.

T. A. Stiles, superintendent of construction at the U. V. X. smelter, near Verde, Arizona, is going to Oroya, Peru.

Ernest Lee Swift (formerly E. L. S. Wrampelmeier) has changed his name according to Court order September 16.

L. H. Goodwin, who is associated with the firm of Rogers, Mayer & Ball, New York, is examining mines in Nevada.

W. F. Smeeth sailed from San Francisco on September 24 on his way from London to the Mysore district of India.

Eugene Davis has been attending the convention of the American Bankers' Association and is now at New York.

P. M. Anderson sailed from San Francisco, on his return to Johannesburg, by way of Yokohama, on September 24.

Charles P. Perin, who has been acting as advisory engineer to the Tata Iron Works, in India, is returning to New York.

Arthur J. Bensusan, manager of the Passagem mine, in Brazil, is at New York, on a visit to American mining districts.

F. G. Cottrell, Chief Metallurgist to the U. S. Bureau of Mines, has gone to Los Angeles, on his way back to Washington.

Fred V. Berger, formerly at Treadwell, Alaska, is Major and Chief Quartermaster of the First U. S. Army Corps in France.

David McClure and **James W. Neill** have returned from an expedition to the Peace River country, in north-western Canada.

L. V. Cummins, who has been erecting a cyanide plant for Jacket-Crown Point-Belcher Mines Co. at Gold Hill, Nevada, is in San Francisco.

Leslie Bradford, metallurgist to the Broken Hill Proprietary Co., at Newcastle, N. S. W., sailed from San Francisco homeward on October 1.

David J. Kinzie, formerly in charge of the Treadwell employment bureau, is now Captain in the Adjutant-General's Department, at Camp Lewis.

Keith Roberts has received a commission as Ensign in the U. S. N. R. F. until he has completed a short course at Annapolis, when he will be given the same rank in the regular Navy.

R. S. Handy, mill superintendent for the Bunker Hill & Sullivan company, has received a commission as First Lieutenant in the Engineer Corps.

R. M. Jones, mining engineer of Goldfield, Nevada, has received a commission as Captain of Engineers and is now at Camp Humphreys, in Virginia.

Carlos W. Van Law has resigned as vice-president of the United States Smelting, Refining & Mining Co., and will resume general consulting practice.

Murray Innes, **H. W. Gould**, and **Clifford Dennis** will attend the quicksilver conference before the War Industries Board at Washington on October 23.

A. D. Hughes, manager of the dredging department of the Yukon Gold Co., has enlisted in the Engineering Corps of the Army. He is succeeded by **D. H. Perry**, of San Francisco.

John E. Orr, engineer to the Mount Morgan, in Australia, has been discharged from the British army after serving with distinction for three years and attaining the rank of Captain.

R. V. Mills, petroleum technologist of the U. S. Bureau of Mines, with headquarters in San Francisco, is at present in West Virginia where he will be engaged in Bureau work for several months.

Claude Ferguson has resigned as superintendent for the Copper Queen Gold Mining Co., at Stoddard, Arizona, to accept a similar position with the Consolidated Arizona Smelting Co., in charge of the operation of the De Soto and Swastika mines.

J. W. Moffet, manager of the Beaver mine, at Cobalt, Ontario, has resigned, owing to ill health. He is succeeded by **L. W. Ledyard**, who formerly managed the Teck-Hughes mine at Kirkland Lake.

T. Ernest Godson, Mining Commissioner for the Province of Ontario, and **J. Sutherland**, Chief Inspector of Mines for the same Province, are paying a visit to British Columbia for the purpose of making an investigation of Western mining conditions.

C. P. Bowie, petroleum engineer in charge of the U. S. Bureau of Mines petroleum station at San Francisco, has returned from a short trip to Colorado where he attended meetings held by the Bureau of Mines and also the meetings of the American Institute of Mining Engineers.

F. B. Tough, petroleum technologist of the U. S. Bureau of Mines, with headquarters in San Francisco, has returned to Illinois to continue co-operative work with the State officials and with the officials of the State University in the matter of cementing oil-wells in the southern fields of the State.

A. W. Ambrosé, acting chief petroleum technologist of the U. S. Bureau of Mines, is spending a few weeks in California on investigations in connection with the work of the Bureau. **C. H. Beal**, petroleum technologist of the Bureau, is taking Mr. Ambrose's place during his absence from Washington.

Francis Oats, chairman of the De Beers Consolidated Mines, died at Port Elisabeth, in South Africa, on September 1.

William Kent died on September 18, at the age of 67. He was editor of the 'American Manufacturer' for two years and of the 'Engineering News' for eight years. In 1895 he published his 'Mechanical Engineer's Pocket Book,' through which he obtained a wide reputation and an enduring name.

The American Institute of Mining Engineers will hold a meeting at Milwaukee, Wisconsin, during three days beginning October 8. Prominent members of the Institute of Metals division, and the Iron and Steel section of the Institute will be in attendance. The Milwaukee meeting will be held simultaneously with the annual meeting of the American Foundrymen's Association.

THE METAL MARKET

METAL PRICES

San Francisco, October 1

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	16
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	12
Zinc-dust, cents per pound	16

ORE PRICES

October 1

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, California, per unit	$20—$25

The chrome situation, according to Albert Burch, who has received information from the War Industries Board, gives every indication that the quantity of domestic ore produced during the remainder of 1918 can be sold at the first price prevailing during the summer months, and producers are instructed to wire the Board if they are unable to find a ready market. In wiring the Board, tonnage, price, and guaranteed analysis should be given. It is the present intention of the Board to arrange for continued chromite production in the United States for the first half of 1919 at a rate proportionate to 1918 production. The trade will be asked to purchase chromite produced in the United States during the first half of next year at this rate.

EASTERN METAL MARKET

(By wire from New York)

October 1.—Copper is unchanged. The scarcity of lead is unrelieved. Spelter is inactive and easier.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date		Average week ending	
Sept.	25	Aug. 20	26.00
"	26	" 27	26.00
"	27	Sept. 3	26.00
"	28	" 10	26.00
"	29 Sunday	" 17	26.00
"	30	" 24	26.00
Oct.	1	Oct. 1	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Sept.	25	Aug. 20	8.60
"	26	" 27	9.16
"	27	Sept. 3	9.42
"	28	" 10	9.41
"	29 Sunday	" 17	9.62
"	30	" 24	9.76
Oct.	1	Oct. 1	9.55

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

	New York,	London,	Average week ending	
Sept. 25	101.12	48.81	Aug. 20	100.25
" 26	101.12	48.81	" 27	101.12
" 27	101.12	48.81	Sept. 3	101.12
" 28	101.12	48.81	" 10	101.12
" 29 Sunday			" 17	101.12
" 30	101.12	48.81	" 24	101.12
Oct. 1	101.12	48.81	Oct. 1	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Exports of Canadian silver coin, silver bullion, and fine silver bars is prohibited except under license issued by the Dominion Minister of Finance. The regulations provide that licenses shall be issued only where the metal is to be used for essential civil or military purposes, and only where the exporter certifies that it has been purchased at a price that does not directly or indirectly exceed $1.01½ per fine ounce, at the point where the silver is refined or at the point of importation in the case of imported silver.

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
Sept.	25	Aug. 20	8.05
"	26	" 27	8.05
"	27	Sept. 3	8.05
"	28	" 10	8.05
"	29 Sunday	" 17	8.05
"	30	" 24	8.05
Oct.	1	Oct. 1	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			Date	
Sept.	3	120.00	Sept. 17	120.00
"	10	120.00	" 24	120.00
			Oct. 1	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	....
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ORES (New York)

Molybdenum: The market is quoted at $1 per lb. with a fair inquiry reported.

Tungsten: An active market is reported for the high-grade ores, but there is not much being offered. The quotation for these ranges from $24.50 to $26 per unit, with the low-grade ores in good demand at $19 to $24 per unit. Italy is in the market for ore, which will probably have to be bought outside of this country. Ferro-tungsten is strong at about $2.25 to $2.50 per lb. of contained tungsten.

Eastern Metal Market

New York, September 25.

Little activity is in evidence in any of the markets, but the tone of most of them is strong.

The copper trade is turning its attention to the question of price changes after November 1, and it is expected this will be decided by October 15.

The future conduct of the tin trade is still a matter of mystery, particularly so far as importers are concerned. The prices are a little firmer.

Lead is scarce with distribution and prices under strict control.

Zinc has become quiet and prices are a little easier and lower.

Antimony is dull and slightly lower.

Fixed prices on iron and steel for the fourth quarter were announced yesterday, and they contained some surprises as to details, but not as to two features—an advance to merchant furnaces making foundry and basic pig-iron and no increase in finished steel prices. An advance of 50c. per ton was asked for Lake Superior iron ore, and 25c. was granted. Birmingham and Pittsburgh were adopted as basing-points for sales of pig-iron, with an advance of $1 per ton for basic and foundry irons. The Pittsburgh basing was limited to furnaces north of the Potomac river and east of the Alleghenies, thus relieving the pinch that has been felt by small furnaces in Virginia, and eastern Pennsylvania. A keen disappointment exists in the fact that the Class 3 steel companies, which buy basic iron in the open market, must now pay more for raw material and realize no advance in finished steel. The semi-steel projectile program of the next eight months calls for an output equaling and perhaps exceeding the present steel-shell production.

COPPER

Fundamentally copper is unchanged. Whether there are to be sufficient supplies of both crude and refined copper in the future is a matter of opinion among those not close to the actual facts. Apparently it all depends on the labor situation, which has been causing not a little anxiety. In some quarters there seems to be a better feeling as to the output of refined copper. One authority, eminently well posted statistically, made the statement that if labor conditions permit the electrolytic refineries to operate up to 70% of full capacity throughout the remainder of the year the outcome will be quite satisfactory. There are rumors that the price of copper will be advanced from 26c. after November 1, and as this date draws nearer it is probable that such rumors will increase. Some are quite confident that no upward change will be necessary. Imports of copper in June are given as only 11,000 gross tons, the smallest of any month this year. February holds the record at 27,000 tons, and January the smallest hitherto at 19,000 tons. For the six months ended with June the total for this year has been 122,500 tons against 135,000 tons in the same six months in 1917. August exports of copper are stated to be 18,829 tons, or the smallest this year. The price for jobbers selling five tons or less is 27.35c. per pound maximum.

TIN

The situation, so far as international control and prices of tin is concerned, continues as mystical as ever, on the side of the importers. The announcements from Washington recently stating that such control is to be an accomplished fact, give no details and leave much to be desired. One statement is to the effect that all "users and dealers" will be licensed, but nothing is said as to importers unless they are included among the dealers. Importers as a class do not yet know whether they are to be eliminated entirely or whether they are to be involved in the new machinery. If not, the question arises as to who is to conduct this rather complicated business after the War. Their elimination now may mean their introduction into other lines of business with no desire to return to it after the War. With this and other questions, and particularly price-control, still undecided, it is not surprising that buyers display no interest and refuse to take hold. The market has consequently been quiet, though late last week there developed some inquiry for far future shipment which resulted in business; the volume, however, was small. In view of the conditions this was to be expected until the dominant question should be settled. It is a fact, however, that there has been little buying for some time and this means a possible shortage of tin during the coming winter. Metal for future shipment from the East can be obtained for about 72c. per lb. Prompt tin is a little higher but nominal at 79c., New York. Arrivals at Pacific ports in September to the 19th, inclusive, have been 2620 tons, with those at Atlantic ports to September 14, inclusive, 1025 tons. The London market is lower, with spot Straits quoted yesterday at £340 10s. per ton, against £343 per ton a week ago.

LEAD

The entire market is in the hands of the Lead Producers' Committee. Even most inquiries are being turned over direct to the committee by producers as they come in. The question of labor continues to dominate the present and the future as to the supplies of lead. There is not enough metal now, and all demands are being carefully scrutinized as to their essential character, for the committee is really trying to make a few tons suffice for many. The agreed prices continue at 7.75c. per lb., St. Louis, or 8.05c. per lb. for carload and larger lots, with less than carloads held at 8.55 cents.

ZINC

The week has been a quiet one and the demand has receded to small proportions. Most producers are well sold up for some time and consumers are also apparently pretty well covered. There are occasional inquiries for small lots for all positions, which are resulting in some sales. Quotations during the week have steadily but moderately declined until yesterday prime Western for early delivery, September-October, was regarded as largely nominal at 9.30c., St. Louis, or 9.65c., New York, with last quarter at about 9 to 9.10c., St. Louis, or 9.35 to 9.45c., New York. The Government's weekly report of production and stocks show a decline in output for the week of only 37 tons. There has also been a decline in stocks of 1978 tons with Grade D credited with 1005 tons of this decline. Grade A zinc has a maximum Government price of 12c. per lb., but sales have been made frequently below this.

For sheet-zinc the fixed maximum price is 15c. per lb., and for plate-zinc 14 cents.

ANTIMONY

The market is quite dull and inactive, with the quotation slightly less at 13.87½c., New York, duty paid for wholesale lots for early delivery.

ALUMINUM

There is no change in Government prices, which continue as a maximum for No. 1 virgin metal, 98 to 99% pure, and for scrap at 33c. per lb. for 50-ton lots, at 33.10c. per lb. for 15 to 50-ton lots, and at 33.20c. per lb. for 1 to 15-ton lots.

INFORMATION FURNISHED BY MANUFACTURERS

GRAPHITE AS A LUBRICANT

A microscope shows all metal surfaces to be irregular. The surfaces look like a nutmeg grater. Flake-graphite attaches itself to the high-spots, filling in depressions and forming over the whole surface a thin tough film, unctuous to the highest degree, thereby preventing metal-to-metal contact and substituting the low frictional contact of graphite-to-graphite for the high frictional contact of metal-to-metal. Dixon's flake graphite is unaffected by high temperatures, cannot be carbonized or ignited, cannot possibly give off explosive vapors, will not accumulate dust or grit, does not clog discharge-valves, improves frictional surfaces, prevents metallic contact, reduces the amount of oil or grease, reduces friction, prevents shut-downs, and saves power and fuel. Graphite as a lubricant is not a competitor of greases or oils. On the contrary, the two in most cases go hand-in-hand. Dixon's flake-graphite improves all oils and greases, the oils acting as a carrier to properly distribute the graphite. There are some cases where graphite is not recommended as a lubricant, particularly if the lubricant must be a non-conductor of electricity, as graphite is a good conductor, and, vice versa, there are some conditions when graphite works best alone. The proper use of Dixon's flake-graphite will reduce the cost of cylinder-lubrication at least 50%. A mixture of graphite permanently suspended in oil has no particular advantage over a non-graphited oil as a lubricating material, because the particles of graphite, being in perfect suspension, cannot break through the surrounding film of oil, or easily become attached to the metal surfaces. They simply move about in the oil-film without decreasing the viscosity of the oil itself, the only way in which any reduction could be brought about. In fact, a mixture of finely divided graphite and oil has a higher viscosity than that of oil alone, and so the reduction of friction is not to be sought along this line.

COMMERCIAL PARAGRAPHS

The Pelton Water Wheel Co. has reprinted for general distribution as a circular, the interesting article on 'Improvements in Water-Wheel Efficiency,' recently contributed by E. C. Hutchinson to the 'Journal of Electricity'. It is illustrated by many views of water-wheel installations, some consisting of 5000-hp. units. One of these is further illustrated by sectional drawings. There are also many curves showing daily average load, and efficiencies obtained. In conclusion Mr. Hutchinson says:

"Generally speaking, the impulse or tangential water-wheel has a much flatter efficiency curve characteristic than the reaction-turbine; yet great economy has been effected under certain conditions by the replacement of some impulse-wheels with reaction-turbines, which will deliver a higher efficiency at a point of continuous load output. On the other hand, there have also been instances where, because of the great variation of load and the much better fractional-load efficiencies to be obtained by impulse water-wheels of the multiple-runner, duplex-nozzle type, replacements of reaction-turbines have been effected in a field which, under ordinary conditions, would appear to lie altogether beyond the proper bounds of impulse or tangential water-wheel construction. Furthermore, a considerable improvement in power-output has been obtained by installing turbines of the modern reaction-type to replace turbines of the older and earlier forms of design. Under present conditions, however, there is no question that the water-wheel installations of the impulse or tangential type offer the best opportunity for increased power-output, with the least additional expense to the purchaser, as most forms of turbine-construction do not permit of modification by the substitution or replacement of detail parts for the purpose of increasing efficiency and power-output from the same amount of water. The result is that most turbine improvements are made by installing complete new units."

The Westinghouse Electric & Mfg. Co. is distributing catalogue 1-B, dealing with wiring-devices and carbon circuit-breakers. This is a 224-page, 8½ by 11, catalogue listing fuses, knife-switches, service-switches and boxes, solderless connectors, disconnecting switches, instrument switches, safety switches, safety-panel boards, safety floor-boxes, and carbon circuit-breakers, part of which have previously been listed in the old sectional 3001 catalogue of the Westinghouse company. An entirely new and complete line of knife-switches of the Westinghouse company's own manufacture, both front and rear-connected, the types A and C, are described in 49 pages of this catalogue. A new line of disconnecting switches, known as types P and R, are included in this catalogue for the first time. In listing the carbon circuit-breakers, the Westinghouse company has made a departure from previous practice; they are listed according to what they will accomplish, that is, according to the method of operation, method of mounting, and capacity, the type designation being the secondary consideration in the table of listings. On looking up the circuit-breaker to accomplish a particular duty, all that is necessary is to find from the index the particular table listing the breakers according to the operation and method of mounting desired, and then, in that table, follow down the list until the number of poles, the ampere, and the voltage-capacity are found. A type designation is shown with this so that those wishing to know the details of construction of the breaker which will give the required operating characteristics, can easily find them on the pages of description.

E. P. Dillon, manager of power division of the New York office of the Westinghouse Electric & Mfg. Co., has resigned to become general manager of the **Research Corporation of New York.** Mr. Dillon came to the Westinghouse company in 1909, having been previously connected with various mining and electrical companies in Colorado. In 1917 he was transferred to the New York office as manager of the railway and power divisions. For several years he was assistant to the manager of the Railway & Lighting Department at East Pittsburgh, being in charge of power-house and apparatus work.

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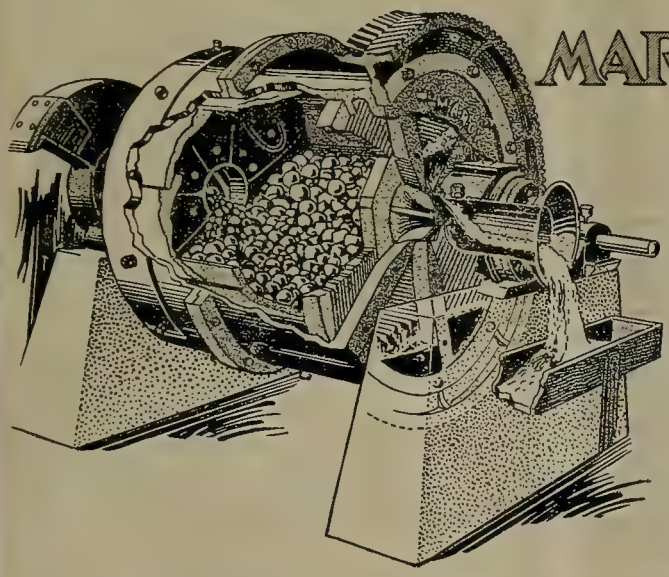

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The Utah Copper Enterprise—II
Process for Recovering Platinum

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EDITORIAL STAFF

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COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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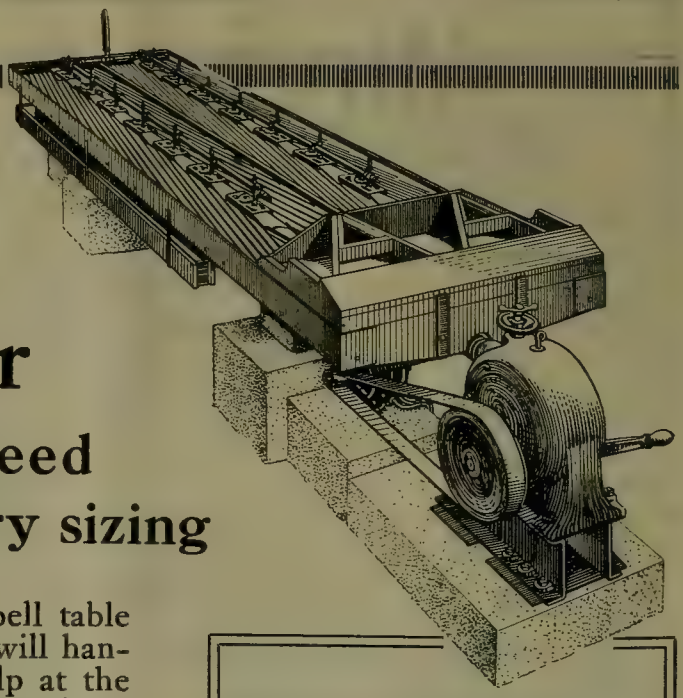

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High class, careful construction distinguishes the Isbell throughout.

YOUR subscriptions to this issue of Liberty Bonds will pay for the victories that you are cheering.

THAT peace-explosive from Berlin is a 'dud'; it will do no execution, except at home.

PLATINUM is much in demand for use in the chemical laboratories that are preparing materials necessary in war. Mr. V. J. Zachert has invented a means of saving platinum and shows his patriotic spirit by not patenting it but by describing his process in this issue, so that it can be used for the Nation's good.

FORTY miners are reported to have struck at the Victor mine, near Tonopah, until three of their fellow-workers, who had refused to buy Liberty bonds, saw the error of their ways. We never heard of a strike being used to better purpose nor do we recall a better proof of the solidarity of Labor in support of the National purpose.

THIS is Columbus day, the anniversary of the discovery of America, 426 years ago; it is one of the days when the Kaiser discovered that Americans were not cannon-fodder; it is the day on which three years ago Nurse Cavell was murdered by the invaders of Belgium; it is Liberty Bond day. Celebrate it in the one logical manner: Buy bonds to bring the War to a victorious conclusion.

WE are amused to see that our New York contemporary has opened its columns to the commercial controversy between the manufacturers of ball-mills, a discussion that we are doing our best to exclude even from our advertising pages. The representatives of these manufacturers have likewise burdened the proceedings of the Institute with a lot of stuff that proves nothing because it is of the 'write-up' character, like the recommendation that Tommy brought from his mother—interesting to the family, but unconvincing to his neighbors.

CARBOCOAL is a new product obtained by distilling coal at a moderate temperature. The material has little resemblance to coke; it ignites more readily, supposedly because of the occlusion of an extraordinary amount of oxygen; and it is easy to pulverize. Fuel-gas and the usual by-products that are recoverable in the retort-coking of coal are equally available when making carbocoal. It is not improbable that it may prove useful in connection with reverberatory smelting. The gas could be utilized in conjunction with the pulverized carbocoal, which information at hand indicates might offer advantages over ordinary pulverized coal.

CHARCOAL has long been known as a precipitant for gold. It was employed early in the application of the cyanide process in California, and has always tempted the metallurgist. The contribution to this subject, by Mr. W. R. Feldtmann, which we reproduce this week, shows that the precipitating effect increases with the fineness of the charcoal, and he attributes this to the colloidal condition produced by extreme pulverization. That no doubt is correct, but it does not explain the reaction. That the carbon does its work best in this active state, in which its adsorptive powers are so conspicuous, taken in conjunction with the further fact that the reaction proceeds best with the aurous salt, should lead to further discussion by metallurgical chemists.

LEST we forget, let it be recorded that the Germans have sunk more hospital-ships than military transports, and that when they assassinated the women and children on the 'Lusitania' they struck a medal to celebrate the event and proclaimed a holiday for the schoolchildren of Germany that they might applaud the cowardly deed. Now the American soldiers go over the top shouting 'Lusitania,' and the day has come when the Hun is finding no trench or fortress strong enough to protect him from the avengers. He is unrepentant, although he begins to whine about defending his land from those that are driving him back to his lair, after invading, marauding, and despoiling the hearths and homes of millions of innocent people in Belgium and France. When the beast has been caged, it will be time enough to talk about pardoning his sin; until then it is sanctimonious blasphemy.

NEWS from the front usually fails to be pictorial, because the scope of action is so large and the newspaper correspondent is rarely placed so as to make accurate observations. However, occasionally a pen-picture is transmitted over the wire. Here is one that we rescued from a mass of confused writing a few days ago. We

give it in abstract. The main assault was launched at dawn under cover of a creeping curtain of shell-fire. An American division advanced shouting 'Lusitania.' With them went a squadron of tanks. While this attack was progressing favorably, a British division on the left swam the canal and pushed forward, in the face of steady machine-gun fire, to the village of Belleglise. By nine o'clock prisoners were being sent to the rear in droves. A pause followed this first phase of the battle. The Americans, tired but elated, stood in the trenches they had captured, while the Australians, moving to their support, passed over them, or 'leap-frogged,' to form the first wave of a renewed advance. The storm of cheering that greeted this manœuvre rose high above the din of battle. . . . Those cheers will find an echo round the world wherever a common language and a common ideal unite the English-speaking peoples.

THE annual Exposition of Chemical Industries has become an event of national importance. The fourth has just been held in New York, with a large representation of exhibitors and a greater throng of visitors than ever. America is developing as a manufacturer of chemicals on a scale such as to ensure us the leading position among the nations, and the expositions held under the auspices of the American Chemical Society are performing a great service in promoting this development. The work of the metallurgist is inextricably interwoven with that of the chemist, and the utilization of by-products is leading the smelters to expand their field of operations so that plants devoted primarily to the reduction of copper, lead, and zinc are becoming complicated with a train of subsidiary chemical industries. Therefore, it is not suprising to find a long list of metallurgical companies among those represented at the Chemical Exposition, including such concerns as the Anaconda Copper Mining Company, the New Jersey Zinc Company, the Nichols Copper Company, and dozens more. The features relating more definitely to the metal industries will be reported in our correspondence department.

PRODUCERS of zinc in the Komspelter region of Kansas, Oklahoma, and Missouri have been complaining that they do not receive a fair price for their product, the market for the zinc concentrate failing to keep step with the quotation for spelter. It is proposed, therefore, to erect concrete warehouses and to store the concentrate therein, with the idea of forcing the smelting companies to go into the open market and pay higher prices. Warehouses, for this purpose, are being built at Picher and Douthat in Oklahoma, and it is said that others are to be built in the neighboring mining districts. The Oklahoma Mining Exchange of Miami is backing the scheme, and the Oklahoma Ore Producers' Association of Picher is asking for the co-operation of the mine-owners in the entire Komspelter region. We await eventualities. It seems likely that if the scheme should be carried out, and a large tonnage of concentrate be stored, the menace to the market will outweigh the benefit of controlling the supply. The ancient law of supply and demand is stubborn. Our friends in the zinc industry are running their heads against a brick wall. We note also a full-page announcement, in the 'Joplin News Herald,' that the mining men of Joplin consider, not without reason, that they have been "betrayed by the Democratic party" because zinc has been imported in large quantities from Mexico, Australia, and Spain. The statistics they themselves publish show that the big importation was in 1916 when the total was 385,964 tons, whereas in 1917 only 211,000 tons was imported, and during the first half of 1918 only 39,718 tons. So "vote for the Republicans and restore the tariff," shout our friends at Joplin. That seems natural, for the big importation was made before we entered the War. However, this is not a time for party politics. Damn the Kaiser, gentlemen, if you must let off steam, not the Government. We cannot afford to mix political parties with Uncle Sam just now.

The 'Lusitania' Test

Supporters of decent journalism have been surprised and disappointed by the sudden lapse of the 'New York Times' when on September 15 that paper published a nerveless editorial advising the Government to meet the representatives of Germany and Austria in a peace conference. The suggestion was denounced instantly in letters from thousands of the 'Times' readers, but none of these was published, the editor of the 'Times' contenting himself with a brief and lame retraction ten days later. This was an irretrievable blunder. The 'Times' ought to have published a selected number of the denunciatory letters and omitted the retraction, which was unconvincing, as is suggested by the 'Manufacturers' Record,' which has offered the 'Times' $5000 for the letters and telegrams sent in protestation, it being the belief of our excellent contemporary at Baltimore that the publication of the correspondence would be read eagerly by the American public. With this we agree heartily. It is a thousand pities that the 'Times' should have besmirched its own record by such an error of judgment, for the leading paper of New York has done great service for the Allied cause since August 1914 and in other respects has held the premier place among the newspapers of the world. Another periodical that has gone wrong, in a sense deeper than the blunder just discussed, is the 'Nation.' The issue of September 14 was detained by the Post Office for an improper article criticizing the mission of Mr. Gompers abroad. We are not surprised that the editor of the 'Nation' has come under the ban, for his talk while at the University of California last March was offensive to all good Americans. His father was Henry Villard, whose real name was Hilgard; he himself was born in Germany, and while here he talked a lot of watery nonsense about internationalism. In such cases the best test is that of the 'Lusitania.' Any man that approved of that assassination is either a moral pervert or a pro-German, or both. On May 10, 1915, this same Mr. Villard wrote, over his own signature in the

New York 'Evening Post,' which he then controlled, as follows: "Had the submarine given thirty minutes' warning to the crew and passengers of the Cunarder, the exploit would have gone down in history as one of the most brilliant in the annals of naval warfare." What would his maternal grandfather, William Lloyd Garrison, have said to that! Moreover, what would Edwin Lawrence Godkin, who made the 'Evening Post' a great newspaper, have thought to see such a stupidly evil statement over the signature of his successor! The 'Nation' and the 'Post' have held a high position in the American journalism of the past, so it is to be hoped that Mr. Villard's connection with the 'Nation' will soon end, as it has already with the 'Evening Post.' It is fitting to revert to Hearst in this connection, for he also gave himself away in a signed editorial on the 'Lusitania' horror. On June 6, 1915, in the 'American' he wrote: "Whether it [the 'Lusitania'] was armed or not, it was properly a spoil of war, subject to attack and destruction under the accepted rules of so-called civilized warfare." We would like to see that statement recorded on a tablet at the Greek theatre, which Hearst gave to the University of California, and, ill content with a small acknowledgment not too prominently placed, insisted on a large entablature advertising the fact that the theatre was "A Gift from William Randolph Hearst." That advertising sign on the front of a classic replica is like a trading-stamp on the forehead of a fair woman. It should be deleted, and replaced by Hearst's dictum on German piracy, just to remind the youth of California that the Hearst money has debauched the journalism of San Francisco and befouled the fame of the University itself.

The Peace Offensive

A "manœuvre to gain the moral initiative" describes the proposal made by the new German Chancellor. That is the phrase used by Mr. Frank H. Simonds in discussing the recent Austrian proposal, and it fits the German sequelæ. By the time these pages reach our readers the President will have replied curtly and incisively to the insulting 'offer of peace' from the Kaiser's parliamentary puppet as he did to that of the Austrian emperor. He will, we trust, reiterate his refusal to "bargain or compromise with the government of the Central empires . . . because they are without honor and do not intend justice." We feel confident that the Allies will stand firmly on the assertion that no conference for peace, least of all an armistice, can be granted so long as a single invader remains on the soil of France, Belgium, Italy, Serbia, or Russia, so long as a single marauder has his hands on the spoil he has seized in disregard of the law of nations. This German move is as much a part of their campaign against us as were the offensives that they launched in the spring; having failed in their military attacks they now fall back on a diplomatic ruse to gain time and restore their badly battered morale. The sword, which drips with the blood of innocent women and children, of non-combatants and of hospital patients, is held in one hand while the pen, of the perjurer and brigand, is flourished in the other. The ruse is too palpable. We know the Enemy by this time and we shall be damned to all eternity if we close our eyes to our knowledge of his sinister insincerity. When the German says peace he means an arrangement for escaping the logical consequence of his attempt to hold civilization by the throat; when he talks of compromise he is like the burglar caught in the act with his hands on the silver attempting to cajole the indignant householder; when the Kaiser speaks of an "honorable" peace he means an *advantageous* escape from a deadly dilemma. It was fortunate that the German ruler issued his proclamation so soon after his Chancellor's pronouncement, for by doing so he made clear the meaning of the move. Almost before Prince Maximilian had finished his speech, in which he laid stress on the representative character of the Reichstag and emphasized his desire to express "the will of the people," his imperial master had issued a proclamation, ignoring both the Chancellor and the Reichstag, and personally assuring the German people that *he* would only extend *his* hand for "an honorable peace." Note also what the Chancellor said. "The program [of these German negotiations with the Allies] will not permit the peace treaties hitherto concluded to be a hindrance to the conclusion of a general peace." Indeed! Then the solemnization of treaties with Ukrania, Russia, and Rumania was merely the joke of the War-lord, and the be-ribboned documents were to be treated like that other 'scrap of paper,' for which the world is exacting plenary damages. Again, after explaining a few changes in the relation of the ministry to the Reichstag, and suggestions for extension of the franchise restricted to the separate kingdoms, duchies, and other members of the German federation, which in no wise trim the claws of military autocracy, he assumes that the outer world is not sufficiently instructed concerning the political institutions of his country to comprehend the shallowness of the proposed reform; so he hopes to make it seem that Germany has complied with the democratic prescription written by Dr. Woodrow Wilson, and once more reveals the duplicity inherent in every Teutonic utterance, in the following words: "The striking force that the Government has in its striving for peace depends on whether it has behind it the united, firm, and unshakable will of the people. Only when our enemies feel that the German people stand united back of their chosen leaders—then only can words become deeds." In other words, they are pretending a democratic form of government in order to persuade the Allies to negotiate with them. The fact is plain that the Germans, having failed in their criminal scheme to dominate the world by ruthlessness and terror, are becoming anxious to avoid the utter defeat that stares them in the face. So they want to bargain, in the hope of staying the advance of the avenging armies of the defenders of human liberty. They think to impair the Allied morale as they did with their peace offensive in December 1916. But, thank God, it is too late for them to hope to succeed, for the morale of the Allies has been

strengthened to steel by the aid of the American armies, which are moving forward with the heroic spirit and deadly effectiveness that express the whole-hearted support of a united people. We intend to see this thing through; there can be no pact with an outlaw. The Enemy is unrepentant; he merely tries to evade the penalty of his failure. He must evacuate the territory he has invaded, restore the property he has stolen, pay for the damage he has done, and surrender for trial the criminals that caused this calamitous war.

Financiers Endorse the Gold Propaganda

The conservatism and sound economic sense of the gold-producers have borne splendid fruit. There were those that prophesied failure, that doubted whether any good thing could come—we do not say out of Reno, but out of a convention of gold-miners, who might be suspected of mingling selfishness with patriotism. Naturally the two attributes become confused, but that does not involve the hoggishness of the profiteer. Even a patriot if he is to live must have goods, and to get goods he must continue to make money. The gold-miner merely asked for the privilege of remaining in existence; he said so at Reno, and again at Spokane; he also declared his respect for our present monetary basis, and renounced any intention of tampering with the standards of finance, even if he were forced out of business for standing by his sound-money principles. The Eastern financial journals published the Reno resolutions with scarcely concealed surprise; they had heard that the gold-miners wanted to raise the price of gold, and here came their definite statement that they neither wanted nor expected any such thing. All they wanted was relief, and they left it to the wisdom of the Administration and of Congress to construct a feasible plan, aided by the suggestions that they themselves might offer. This declaration for sound money attracted wide attention and won sympathy among the financiers and bankers of the country. It constituted one of the strong arguments that persuaded the American Bankers' Association to go on record so emphatically in favor of granting assistance to the gold-producers. Next we find the 'Wall Street Journal' supporting the proposal and presenting figures to show the need; and now the scholarly 'Commercial and Financial Chronicle', in a ringing editorial, has pronounced for Federal aid to increase our supply of gold. We reproduce this thoughtful statement on another page of this issue. The editor of that paper demolishes the objections to a bounty by the gentle reminder that "It is probable, if failures to find it [the gold in the earth] were counted, it never did pay a comparative cost of production in any country, not excepting the fabulously rich sands of Alaska"; and he goes to the heart of the matter when he says, "It is amount we want, and may need. The standard will take care of itself; we would not change it if we could, and could not if we would. Yes, we could—with the result of tumbling credits over the whole world like a house of cards, and spreading commercial ruin more disastrous than the physical destruction of 'the greatest war in history'." The East is convinced; the sound financiers are the friends of the sound-money gold-producers. They can henceforth work together, and they will be able to save the country from the calamity of having the stream of new gold for our Treasury dried at its source.

Spanish Metals for the Allies

It is a pleasure to record the operations of a great mining and metallurgical company, the Peñarroya, that has worked loyally in Spain for the good of the Allies throughout the War, and that, in doing so, has prospered without let or hindrance by the Spanish goverment. We know that the German propaganda in the Peninsula has been intense, so that all Spain has been divided, not as Gaul into three parts, but into two camps, the Aliadófilos, and the Germanófilos, so that even the restaurants, in order to save their crockery from being used as ammunition in the valient defence of these predilections, had to post notices prohibiting all discussion of the War. It is the common people in Spain that have yielded chiefly to the Teutonic influence, which may be explained by the extraordinary development of the doctrines of socialism and anarchism in that country. In the socialists the Germans found a ready pseudo-philosophic sympathy; in the anarchists a torch that might be useful, as a last resort, if, as they feared, the Allies should succeed in forcing Spain to co-operate actively with them. Fortunately for the world, the socialists and the anarchists in Spain hate and distrust each other as cordially as both hate the rich and the titled aristocracy. There has, consequently, been no co-ordination of the Teutonic propagandists in Spain, and while the demagogues have made pandering speeches that have stirred the bull-rings with as much enthusiasm, especially on the side of the bleachers, as if a matador had made a classic sword-thrust, the ministry, whether headed by Dato, Maura, or Romanones, has gone on its equivocal way, but actually never taking steps to interfere vitally with a sort of neutrality that has proved in the end benevolent to the Allies. The English mining companies can corroborate that; their shipments of copper and pyrite have not been halted. Administrative difficulties there have been, at times, but appeal over the head of the local official has brought governmental relief. Neither have the profits been absorbed by crushing taxes. As concrete evidence of this is the summary of the report of the great Peñarroya Mining & Metallurgical Company appearing on another page. It is a French corporation, one of the largest producers of lead in Europe, operating famous mines in the south of Spain, and, after shipping 170,000 tons of refined lead, 1873 tons of spelter, and nearly eight million ounces of silver, to France and England, it has been permitted to distribute to its shareholders in France the sum of $2,350,000, earned in 1917, which represents 16% on the common stock. That speaks with sufficient emphasis in answer to those trouble-makers who have been endeavoring to create hard-feeling between us and Spain.

Encouraging Gold Production

*It is a very interesting and important matter that is brought to public attention by the recent conferences of gold producers, and which received consideration at this week's meeting of the American Bankers' Association. The inevitable scramble for gold after the War is a vital, if not a threatening, problem of the future. There need be no alarm over a possible recurrence of agitation in favor of bimetalism. The 'standard of value' was never more firmly fixed in the world than it is today. All this vast indebtedness of war is payable in terms of gold—and any other form of payment will constitute plain repudiation. As to the suggestion of a return to the 'double standard', silver may have an enhanced market value, due to increased use because of war's circumstances affecting certain countries, but that market value of silver is measured in terms of gold, and any attempt to re-monetize it at war-prices would present again the old uncertainty of a shifting scale. Twenty-five or thirty million Government bondholders in the United States, and a similar number in other commercial countries, will hardly desire to take payment in silver, instead of gold as provided, only to find that precious metal dwindle in their hands. A dead delusion is hard to revive. The standard of value is not dependent for its effectiveness as a standard on the amount of gold in the world. Gold at a premium would not destroy the measuring value of a standard fixed by world-wide commercial experience and sanction.

But we do need more gold, and every nation needs more gold. Why? Well, here is one illustrative answer—for the same physical reason, in charatcer, not in kind or extent, that we need more yard-sticks to measure ten million bolts of cloth than ten thousand. Gold does not 'circulate'. It is not adapted to this—paper based on gold dollar for dollar is better—there is no abrasion and loss. Gold is used to pay balances. When credits have reduced themselves by cancellation to mere remainders, there must be something to pay the differences in, something that does not change, and it is by consent of common use, gold. By its world-adoption this gold as a standard of value, though recognized by governments as a legal tender for convenience of the people, is really independent of legal-tender qualities which can never operate beyond national boundaries. Gold pays the debt anywhere and everywhere—commerce says so—and commerce is wider and longer than political governments. Coinage values disappear, and a given commercial value, a standard, appears when we cross from country to country. All moneys decreed by governments translate into the denomination-weight of that coinage which has the most widespread recognition, by virtue of extent of commerce, in the marts of the world. At present it is probably the American gold dollar. Out of this translation grows international exchange—now muddled by war. If we had a complete effective system of international exchange, an international clearing house acting in the cancellation of indebtedness as our Federal Reserve or city clearing agencies do, we would not need any more gold, the world would not need more than exists now. Colossal war credits increase the number and volume of remainders, international banking machinery breaks down, hence, more gold to settle remainders. At present we are not settling—we are issuing more credits, increasing the need against the days of reconstruction.

There are 23.2 grains of pure gold in a dollar coin; $20.6718 in an ounce. Before the War there were grains enough, ounces enough, for the world's needs. Bars were shipped in preference to coin. Weight, grains, and ounces, paid any debt, because no debtor refused, and remainders were certainties—the 'standard' was physically as well as theoretically sufficient for commerce, trade. Now that electrically charged barbed wires, great guns, submarines, and bombing airplanes divide the nations, the translating process, international exchange, breaks down, while the basis of settlements, the volume of debts, increases to almost inestimable proportions, and, as we have said, the settlements, final, are not made, they await the resumption of trade, the offsets between nations as well as individuals. These are to come, and with them an attempted renewal of trade on a grand scale, causing, if it comes, increased remainders. But no matter what comes, the standard is secure—the grains in a dollar—and the corresponding computed grains in every other coinage. You may put the English pound in place of the dollar if you choose—an unchanged standard of value.

Therefore, we need more gold. Every nation does. Some of them will buy it, if they can. Some may order (legal-tender) their subjects to take payment in other metals, and internally fix a price thereon, and thus repudiate debts. The 'standard' will stand, nevertheless. Mark—the history of the world is being written in gold, as well as blood. We do not specially need more gold now. We already have more than our share, some think more than is good for us. That is a fallacy—and it should not be forgotten that we are steadily adding to our debt based on gold. But we may need more gold—when the War is over and democracy opens the gates of trade over the seven seas. An ounce of precaution is also worth a pound of cure. If it is a good monetary and financial policy to sequestrate all our gold in the vaults of the Federal Reserve Board and banks, where it will be hard to get when we mayhap shall need it to pay commercial balances incident to our assumed coming domi-

*Editorial in 'The Commercial and Financial Chronicle', New York, Sept. 28, 1918.

nance in world-trade (gold does not rigidly follow the balance of trade as between two peoples or nations), then it would be good policy to get more now, if we can. It is here, in mountains and valleys, but hard to find. It is probable, if failures to find it were counted, it never did pay a comparative cost of production in any country, not excepting the fabulously rich sands of Alaska. It is a very simple proposition, that, with new processes alone making possible the utilization of low-grade ores, and with labor soaring in wages all the time, the cost of production now will diminish the amount of production. It is amount we want, and may need. The standard will take care of itself. We would not change it if we could, and could not if we would. Yes we could—with the result of tumbling credits over the whole world down like a house of cards, and spreading commercial ruin more disastrous than the physical destruction of 'the greatest war in history.' But that is inconceivable folly. Why, then, is there not a duty incumbent here to study the question of how to increase the output of gold?

Meanwhile, our great banks are establishing branches in foreign countries. If all nations would do the same, not only would world-trade be facilitated, but the need for volume-of-gold would be diminished. Some day, perhaps, we will have a perfect international system of interrelated banks, with an international clearing house for all, and then we will have attained true economy in the use of gold. A perfect democracy will tend to ensure this —but it has not yet come. Dangers are often imaginary, and panics come from imaginary causes on occasions. At all events, why not encourage gold production, as a mere precaution, while we are encouraging everything else from fixed double prices on wheat to a spoonful of sugar a meal for saving. It is an open question. But gold will be a live question when the dynasties are dead and autocracies no more forever.

Salvaging Metal From European Battlefields

Europe's battlefields have been showered with steel and iron and brass from shells, exploded and unexploded, and from hand grenades. Much of this metal will be removed as a necessary preliminary to the resumption of peaceful pursuits. The quantity of metal is so great that it would be a source of annoyance, and even of danger to the tiller of the soil. A systematic sweeping, so to speak, of all the bombarded regions will be necessary. A French engineering journal describes an apparatus which, though created for this special purpose, can be applied to other uses, for it will indicate the presence of steel and iron not too deeply buried in the soil. This, however, is a slow way to proceed where long-continued bombardment has literally filled the soil with metallic fragments. Methods of salvaging are contemplated that involve passing the soil through plants for recovering the metal, and returning the soil to its place, levelled and ready for tillage. It is also pointed out that the concentration of fixed nitrogen in these battlefield-soils, resulting from the enormous quantities of explosives used, will make these areas exceptionally fertile.

Gold-Secured Currency for China

Tsao-Julin, Chinese Minister of Finance, in his recent petition to the President of the Republic, states that in February 1914, the Government promulgated a coinage law, the object of which was to unify the silver currency as a preliminary to the adoption of the gold standard. He shows that China would suffer great loss in exchange if silver should fall in price, and if it should rise it would disturb the appropriations in conformity with the budget. Since the outbreak of the War in Europe, China has made large gold loans to the Allies, so that she is now suffering greatly on exchange, and in the event that gold should return to its normal value-level, China would pay dearly again for what she has borrowed, thus suffering double losses. The fluctuation of exchange between gold and silver long has been a serious handicap, causing incalculable losses in Chinese commerce, and making the development of Chinese industries impossible. This makes the immediate adoption of the gold standard imperative.

China has but little gold. It is difficult to mint gold coins at once. It is also difficult to fix the ratio between gold and silver owing to abnormal conditions created by the European war. So it is necessary to have a transitional program. Liang Chi-chao's program is: (1) Strictly to enforce the National Coinage Law of 1914 to secure unification of silver currencies. (2) To clear up paper-currency entanglements to secure a sound note-issue. Then to issue gold-notes as a preliminary step to the adoption of the gold standard. Liang also approached the Quadruple Group of Banks for a currency loan to carry out his program. The Group represented by the Yokohama Bank advanced Y10,000,000 during Liang's tenure as Finance Minister, another Y10,000,000 during Wang Ko-ming's time, and another Y10,000,000 during the encumbency of Tsao-Julin.

The conclusion arrived at is that three steps should be carried out: (1) Unify silver currencies; (2) adjust the note issues; (3) issue gold-notes. The gold-note issue, as preliminary to a gold-standard, was suggested by Dr. Vissering in 1912, and is similar to Liang Chi-chao's idea, which is to fix the new unit, to be called the Chin-yuan, or gold yuan, containing 0.752318 gramme of pure gold. The gold-notes will be issued by banks designated by the Government, and empowered to raise the necessary capital for establishing a trading company to conduct international business. The gold-notes are to be exchangeable at specified banks for foreign gold coins or for 'string-gold.' The banks of issue are to maintain a fixed gold-reserve, subject to periodical official verification. There shall be no restriction upon the size of the secured issue of notes, and such currency is to be legal tender. A Currency Bureau is created, members to hold office 10 years, having a Director General in conjunction with the Minister of Finance, a Governor, and a special Advisor.

The Utah Copper Enterprise—II

History (Continued)

By T. A. RICKARD

Enter Capt. Joseph R. De Lamar. This actor has played a part in mining romance all the way from the Sangre de Cristo mountains to Lake Nipissing. He has been known to give the comic touch to the heavy performance of *la haute juiverie* at New York and to render foolish the antics of their super-expert. The Captain is a remarkable man, and he has had a picturesque career. He was born at Amsterdam 75 years ago. He has been a diver; he has commanded merchant-ships between New York and the Bermudas; thus his captaincy is of the sea. He has bought prospects and developed mines in Georgia, Colorado, Idaho, Nevada, Utah, and California. His name is on the postal map. I am told that he is a hard worker; a man of keen judgment, capable of quick shrewd decisions; possessing the rare faculty of looking ahead. Capt. De Lamar has proved himself alert and enterprising; he is an adventurer, using the term in its old sense of one willing to venture, as the Cornish used to speak of the shareholders in a mining enterprise and as the proprietors of the Hudson's Bay Company are still called officially: "the adventurers trading in the Hudson's Bay territory." Had the Captain lived in the spacious times of Great Elizabeth he would have harried the Spanish main, chased the heavily-laden galleons, and taken tribute of the *conquistadores*. In short, Capt. De Lamar is a notable figure in American mining.

De Lamar had known Colonel Wall at Mercur, for, among other dealings, he had bought from him the Brickyard mine in 1894. At that time the Captain's chief of staff, or manager, was Hartwig A. Cohen, now in San Francisco. In 1895 Cohen came to examine Wall's copper prospects; he took a few samples* and made some hand-tests, by panning, the result being a favorable opinion. De Lamar obtained a six-month option on three-quarters of the property at $375,000. A test was made on 76 tons of ore in a small stamp-mill, called the Markham, in the lower part of the town of Bingham. This ore came from the Mackintosh tunnel, then about 300 ft. long, and from two other similar prospecting drifts. The test yielded a concentrate containing 28 to 33% copper, on an ore assaying 2%, the recovery being 60 to 62%.

No business ensued. De Lamar thought the recovery discouraging and the ore too poor; moreover he was intimidated by the weakness of the copper market, which, near the close of 1895, suffered from disturbed financial conditions, the quotation for electrolytic copper falling to 9¾ cents per pound, as against 12 cents a few months earlier.

Three years later, in 1898, De Lamar, probably encouraged by the rise in copper, which was quoted at 12 to 12½c., in the summer of that year, again asked for an option, in order to make further tests and investigations. He obtained an option on a quarter-interest at $50,000 and on a second quarter at $250,000. A preliminary sampling was undertaken by Robert C. Gemmell (Univ. of Michigan, '84), at that time engineer for De Lamar at his Golden Gate mine, at Mercur. Oxidized copper ore was exposed wherever the rock was not hidden by vegetation. On the east side there was more brush than on the west side of the gulch. Some tests were made in a 5-stamp mill, called the Rogers, below the mine, by Daniel C. Jackling (Missouri S. of M. '92), who also was a member of De Lamar's staff, being then metallurgist at the Golden Gate mill. Everybody seemed pleased with the investigation, including De Lamar himself, but that astute financier told Wall that he would like an extension of time in order to do some exploratory work in the mine, and that he was prepared to undertake it if he could acquire a larger interest. Wall replied that he would sell three-quarters of the property for $750,000 cash. That ended the negotiations.

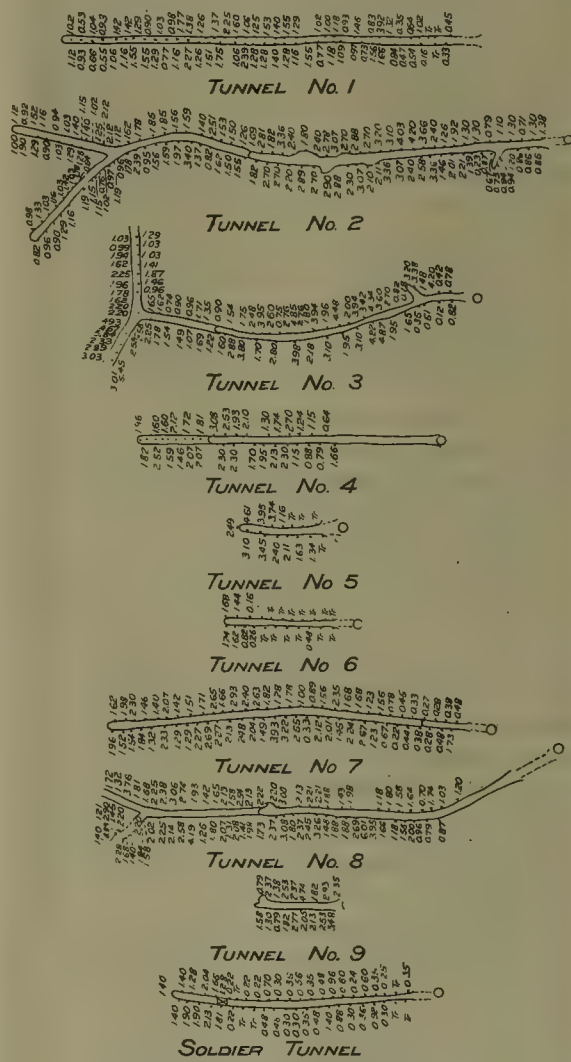
Shortly afterward, at the end of 1898, De Lamar and Cohen had a disagreement, the immediate consequence being that Cohen resigned as manager for De Lamar, his place being given to Victor Clement, on a salary of $36,000 per annum and an eighth interest in anything he found, that is, in any new mining venture introduced by him to the Captain. Clement had returned in 1896 from Johannesburg, where he had been manager of the Simmer & Jack mine, controlled by the Consolidated Gold Fields of South Africa, Ltd. He had met Wall, and a friendly acquaintance had developed. From Gemmell and Jackling he heard about the Wall property; thereupon, early in 1899, he told Wall that he had been going over Cohen's figures and thought he saw the making of a successful venture; he informed Wall that he himself would participate in any business that might result with De Lamar and he could guarantee a square deal. Clement took Gemmell with him to Bingham, and they went over the ground. The result was an offer, by Clement, for De Lamar, to purchase a quarter for $50,000 outright, with a year's option on another quarter at

*Which, he tells me, he assayed by the volumetric cyanide method in a little house on the dump of the Mackintosh tunnel.

$250,000, and on a third quarter at $1,250,000. This proposal was accepted. It was Clement's intention to prove the property and then sell the third quarter through his financial friends in London, thereby obtaining the money needed to build a mill and a railroad from the mine to the mill. During the year of the option De Lamar had the right to test and explore. Clement put James Mason in charge of the mining work and spent $25,000 in extending the drifts and in driving new crosscuts, all of which were carefully sampled by Gemmell. The mill-tests were placed in charge of Jackling, who repaired the old Rogers mill, in the gulch just below the Ohio Copper mine and conveniently near the Wall property. The mill was equipped with a 5-stamp battery, two Wilfley tables, and a vanner. Henry M. Crowther acted as superintendent. The mill-tests served to check the sampling of the workings by Gemmell, and to determine the amenability of the ore to ordinary concentration. I am glad to be able to quote from the report made by Jackling at that time.

This report, dated September 18, 1899, is addressed to Cohen as manager for De Lamar; it is extremely interesting when read in the light of later developments. The report was the result of collaboration between Messrs. Jackling and Gemmell, the latter writing the portions that bore upon the development of the mine, the probabilities of further discovery, the character of the orebody, and the average value of the ore as determined by sampling. I take pleasure in reproducing the map of the principal workings, with the results of the sampling as done by Mr. Gemmell at that time. The assay-figures were written on the original map at the points where the samples were taken, but they would have been illegible when the map was reduced to the size of one of our pages, so I give them separately in another column, with the outlines of the various tunnels, rendering identification easy.

In his report, Mr. Jackling describes the ore-bearing rock as "a very silicious fine-grained porphyry," which has been so fractured naturally that when blasted the ore breaks into small fragments. Where Bingham canyon cuts this porphyry the width of ore is 3000 ft. "The copper occurs in the form of grains of very pure chalcopyrite quite uniformly distributed throughout the mass, there being very little iron pyrites, or other base sulphides of any kind associated with it. Near the surface the oxidizing action has been such that the larger percentage of copper has been converted into carbonates, and, to a certain extent, silicates, and in most cases the copper thus oxidized has been, to a very great extent, leached out of the rock, leaving the values practically nothing on the surface, but increasing rapidly with depth, both as to value and percentage of copper present as sulphides." Thus he recognizes the effects of secondary enrichment. He states that only the tunnels numbered 1 to 9 and the Soldier tunnel have been considered in calculating the amount of ore developed, "no attention" being paid "to shallow surface workings or to incline-shafts sunk on small veins." Evidently, for the sake of simplicity, the workings that were used in making these calculations were numbered from 1 to 9, inclusive, and were so shown on the map accompanying the report. In order to correlate this numbering with the workings shown on the original sampling-map, as reproduced herewith (Fig. 1), it is necessary to say that the order of enumeration from 1 to 9 was Tunnel 1, Tunnel 12, Quinn tunnel, Tunnel 2, Tunnel E, Tunnel 6, Tunnel 15, Tunnel C, Tunnel D, and Soldier Tunnel.



ASSAY-PLANS OF THE PRINCIPAL WORKINGS

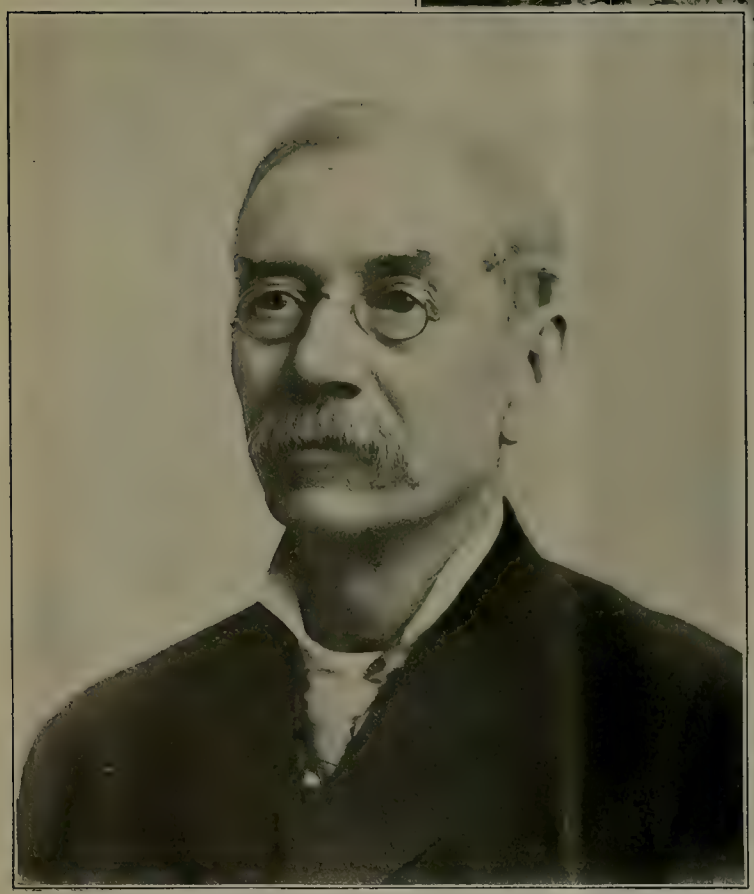
(See map on opposite page)

Samples from raises in these tunnels were used in arriving at an average, but the results from the churn-drill holes were questioned, and therefore were not used. Samples were taken at intervals of 10 ft. on each side, alternating, so that the workings were really sampled every 5 ft. The samples were reduced and quartered in the usual way. Mr. Gemmell tells me that notes were made as to whether the samples represented oxidized or sulphide ore, the assays of the oxidized ore being used in

TRAIN-LOAD OF COPPER ORE CROSSING VIADUCT OVER MARKHAM GULCH, AT BINGHAM. THE COPPER MOUNTAIN IS IN THE BACKGROUND

CAPT. J. R. DE LAMAR

WHO HAD AN OPTION ON THE UTAH COPPER MINE



COLONEL ENOS A. WALL

ORIGINAL OWNER AND PROSPECTOR OF THE UTAH COPPER PROPERTY

DANIEL C. JACKLING

ORGANIZER, FIRST MANAGER, AND NOW MANAGING DIRECTOR OF THE UTAH COPPER COMPANY

ROBERT C. GEMMELL

GENERAL MANAGER FOR THE UTAH COPPER COMPANY

THE MILLS OF THE UTAH COPPER CO. THE ARTHUR MILL IN THE FOREGROUND AND THE MAGNA MILL IN THE RIGHT BACKGROUND; TAILING-POND IN CENTRE

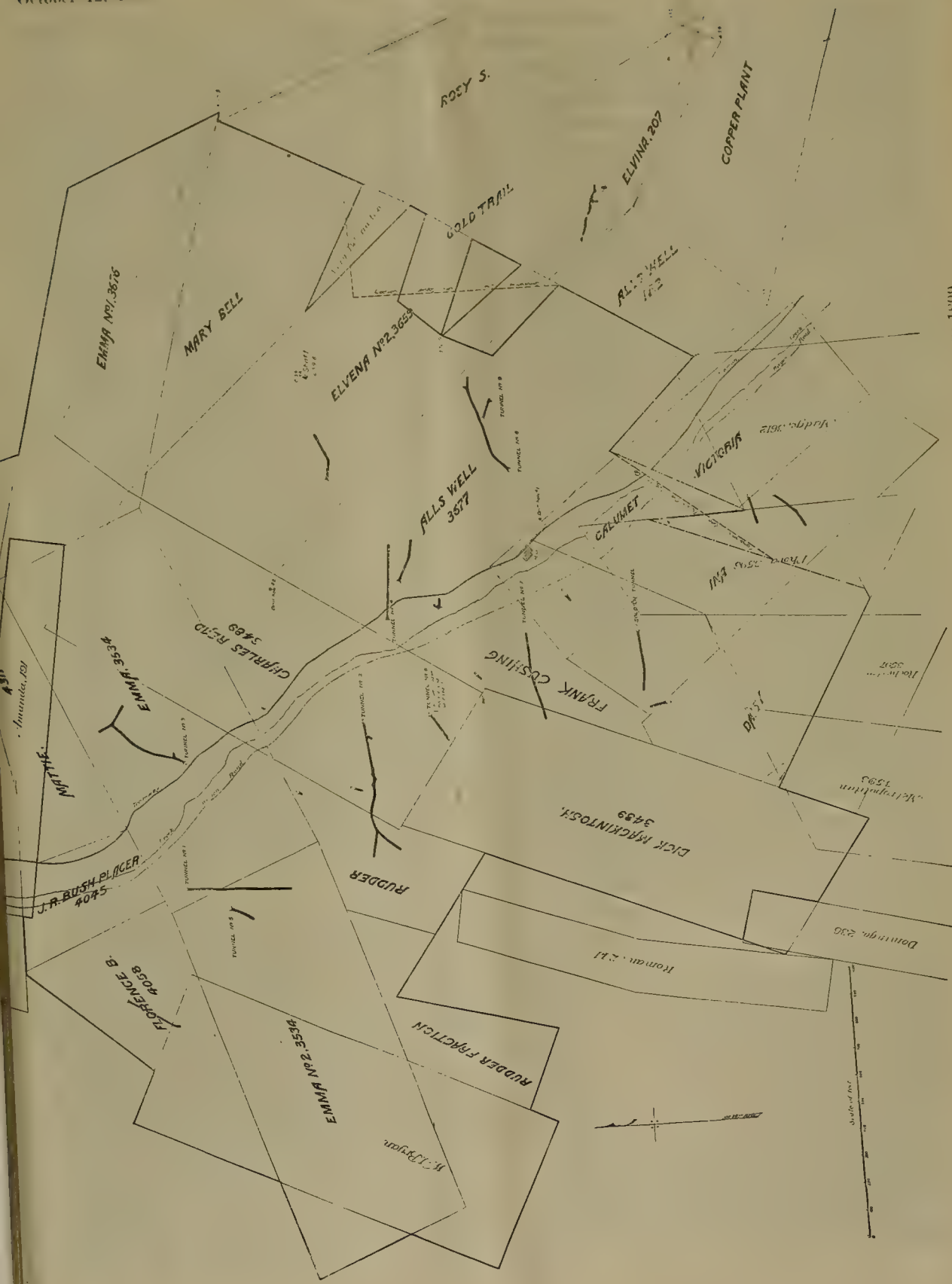


FIG. 1. MAP OF THE WALL PROPERTY, NOW UTAH COPPER MINE, WHEN SAMPLED IN 1899

calculating the average value of the 'cap' and the assays of the sulphide samples for calculating ore. The original blue-print, from which the accompanying map was copied, shows a number of shallow surface workings, such as pits, open-cuts, short drifts, and the like. Generally these surficial diggings had been made at particularly favorable spots, often where the gash-veins of richer oxidized ore had been detected; therefore, the assays of samples from these shallow workings were discarded. Assays of ore from the two tunnels called 9 and 10 on the blue-print were ignored, because these tunnels were not on the Wall property. The total length of workings on the Wall property, including the 2520 ft. done during the terms of De Lamar's option, amounted to 5770 ft. The report states that in estimating the average grade of the concentrating ore 461 samples were used, and as these samples were taken every 5 ft., as explained, they would represent an aggregate length of workings equal to 2305 ft. About 40 ft. of surficial rock (consisting of soil, detritus, and leached porphyry) would have to be stripped and dumped to one side, says Mr. Jackling. He takes 300 ft. as the average length of ore proved by the tunnels, and 200 ft. as the average maximum depth of ore. The length, as exposed in the tunnels on both sides of the canyon, is 2000 ft., "and it is assumed that the ore will be quarried to a plane level with the gulch." Thus he indicates the method of mining he has in view. From the dimensions given, he estimates 167,200,000 cubic feet, which, at 13½ cu. ft. per ton, is equivalent to 12,385,000 tons of ore. This assumes "an equally developed orebody on either side of the canyon". The average assay is 2% copper, as determined from 461 samples broken in the ten principal tunnels, omitting the 40 ft. of stripping. The mine-sampling is confirmed by the mill-tests. In conclusion, Mr. Jackling says that "an estimate of 25,000,000 tons, in addition to that already developed, is conservative as a probability of further production. This estimate is based upon a supposed width, at the northerly end of the property, of 600 ft., at the southerly end 1000 ft., at the middle 2400 ft., with a length of about 3000 ft., and a depth of about 110 feet." All these expectations have been more than confirmed by mining operations. His synopsis is as follows:

Ore at present developed	12,385,000 tons	
Average assay value	2% copper	
Average thickness of waste to be stripped	40 feet	
Average thickness of orebody developed	110 feet	
Estimated cost of stripping waste, per cubic yard	75 cents	
Estimated cost of mining ore, per ton	40 cents	
Estimated cost of hauling ore to mill, per ton	15 cents	
Estimated cost of concentration, per ton (on 2000 tons per day basis)	45 cents	
Estimated total cost of mining and concentration, per ton	$1.14	
Saving made by concentration on 2% ore	75%	
Estimated cost of smelting and refining concentrates:		
Per ton of concentrates	$11.39	
Per ton of raw copper	0.71	
Profits per ton of raw ore (price of Lake copper, 18 cents per pound)	2.83	
Actual cost of producing one pound of copper	0.06	
Profit per month, on basis of 2000 tons daily capacity, taking price of Lake copper at 14 cents	$90,000	
Profit per month at present price of copper (18 cents per pound)	162,000	
Estimated cost of mine equipment		$21,600
Estimated cost of railroad and equipment		232,000
Estimated cost of concentrator		356,000
Estimated cost of smelter and refinery		223,000
Estimated cost of steam-power plant		170,000
Estimated cost of shops, etc.		20,000
Total		$1,022,600

Depth	Hole No. 1 %	Hole No. 2 %
0 to 5	...	...
5 " 10	1.02	...
10 " 15	1.01	0 10
15 " 20	0.64	0.10
20 " 25	0.51	0.15
25 " 30	0.54	0.18
30 " 35	0.50	0.24
35 " 40	0.92	0.28
40 " 45	1.21	0.52
45 " 50	1.49	0.71
50 " 55	1.68	1.30
55 " 60	1.54	1.05
60 " 65	1.50	0.94
65 " 70	1.71	0.54
70 " 75	1.75	0.62
75 " 80	1.58	0.84
80 " 85	1.62	1.42
85 " 90	1.62	1.71
90 " 95	1.87	0.62
95 " 100	1.62	0.62
100 " 105	1.75	0.80
105 " 110	1.87	1.32
110 " 115	1.52	1.24
115 " 120	1.62	1.31
120 " 125	2.00	1.12
125 " 130	1.66	1.12
130 " 135	2.20	0.45
135 " 140	2.18	0.52
140 " 145	2.17	0.71
145 " 150	1.92	1.20
150 " 155	1.79	1.72
155 " 160	1.40	2.34
160 " 165	1.94	2.08
165 " 170	1.94	1.92
170 " 175	1.81	1.84
175 " 180	1.29	1.82
180 " 185	1.83	1.72
185 " 190	2.20	2.18
190 " 195	2.33	2.24
195 " 200	1.91	2.17
200 " 205	2.02	2.12
205 " 210	2.02	2.20
210 " 215	1.77	2.38
215 " 220	1.89	1.78
220 " 225	2.93	1.71
225 " 230	2.30	2.16
230 " 235	2.05	2.00
235 " 240	1.92	1.86
240 " 245	3.46	1.98
245 " 250	2.25	1.82
250 " 255	1.77	1.54
255 " 260	1.89	1.32
260 " 265	2.40	1.52
265 " 270	1.89	1.34
270 " 275	1.13	1.30
275 " 280	1.51	...
280 " 285	1.13	...
285 " 290	1.01	...
290 " 295	1.13	...
295 " 300	1.01	...
300 " 305	1.26	...
305 " 310	0.90	...
310 " 315	0.78	...
315 " 320	0.89	...
320 " 325	0.88	...
325 " 330	0.66	...
330 " 335	0.88	...
335 " 340	0.75	...
340 " 345	0.77	...
345 " 350	0.30	...
350 " 355	0.66	...
355 " 360	1.06	...
360 " 365	0.53	...
365 " 370	0.40	...
370 " 375	0.40	...
375 " 380	0.93	...
380 " 385	0.79	...
385 " 390	0.80	...
390 " 395	0.75	...
395 " 400	0.92	...
400 " 405	1.20	...
405 " 410	1.06	...
410 " 415	1.04	...
415 " 420	1.72	...
420 " 425	0.79	...
425 " 430	2.39	...
430 " 435	1.45	...
435 " 440	1.86	...
440 " 445	1.59	...
445 " 450	1.25	...

It will be noted that the actual cost of producing copper is estimated at 6 cents per pound. In this estimate no charge is made for interest on the investment, only ordinary repairs on the equipment being considered. Including depreciation and interest on investment, the cost is estimated at about 7 cents per pound. The appraisal of the mine is based on an average price of 14 cents for Lake copper, which at that time was the standard and was worth nearly a cent per pound more than electrolytic copper.

In describing the tests made in the Rogers mill, Mr. Jackling states that the equipment consisted of five 650-lb. stamps, two Wilfley tables, and a 6-ft. vanner, the last, however, "was scarcely used at all, as the belt was not in good shape, and it was impossible, with the appliances at hand, to separate the slimes and take them direct to the vanner without using such an excess of water that the work of the machine was worthless." The ore was classified roughly in a hydraulic sizing-box, the coarser material going to one Wilfley table and the remainder, with a large excess of water, to the other table. The mill-tests may be summarized:

Weight of sample lb.	Crushing mesh	Assay Heading %	Assay Tailing %	Assay Concentrate %	Recovery %
418,800	20	1.42	0.43	22.16	58.0
258,400	25	2.04	0.51	23.69	76.5
68,200	30	1.70	0.45	20.98	103.4
149,000	30	1.84	0.34	22.85	97.7
151,600	25	1.37	0.42	16.15	58.9
191,400	25	1.08	0.32	18.95	67.36

The last two tests were made on dump ore, partly leached. It will be noted that the better results were obtained by finer crushing. Discrepancies between recoveries calculated from the differences between the heading and the tailing and between the heading and concentrate produced are due, says Mr. Jackling, "to carelessness in handling concentrates and allowing them to become mixed, and, in this way, weighed and credited to the wrong test." This applies particularly to the third test. The summary of results is given as follows:

Total dry weight of ore milled	574.82 tons
Average assay-value in copper	$1.55
Total dry concentrate	29.339 tons
Average assay of concentrate	21.75%
Recovery, by assay of ore and concentrate	71.70%
Concentration	19.59 into 1

The actual returns from the sale of the concentrate to the Germania smelter, near Salt Lake City, showed 57,000 lb., containing 54,601 lb. net dry weight, assaying 22.10% copper, 0.12 oz. gold, and 1.40 oz. silver; the contents therefore being 12,067 lb. of copper, with 3.27 oz. gold, and 38.22 oz. silver per ton. Payment was made on 94% of the copper at $2.50 per unit, or 12½c. per pound, making $1419.60. All the gold was paid for at $19 per oz., making $62.24. On the silver 95% was paid at 59½c. per oz., making $21.56. Thus the total valuation at the smelter was $1503.40, equivalent to $55.07 per ton of concentrate. From this a smelting charge of $7.98 was deducted, leaving $47.09 net per ton of concentrate, or $1.94 per ton of crude ore. Mr. Jackling estimated the total cost of mining at 54 cents, of haulage to the mill at 15 cents, and of concentrating at 45 cents, making a total of $1.14 per ton. He assumed a recovery of 75% on a 20% ore and a ratio of concentration of 16:1. The cost of roasting, smelting, and refining he estimated at $11.73 per ton of concentrate. This concentrate would yield 451 lb. copper, 1.26 oz. silver, and 0.114 oz. gold, making an aggregate value of $75.26, as against a total cost of $29.97, leaving a gain of $45.29 per ton of concentrate or $2.83 per ton of ore milled.

While this examination was in hand, Clement got into a wrangle with De Lamar over his one-eighth interest, the Captain claiming that the Wall business had been introduced by Cohen, of his own staff, while Clement insisted that the Captain's staff had turned it down and that he himself had initiated the later negotiations, which had proved fruitful. Clement resigned and Cohen came back. Again the Captain dropped the deal, save for the quarter he had bought at $50,000. He had also spent $46,000 in the course of the examination, exploration, and testing. It is likely that his quarrel with Clement was one reason for abandoning the option; another being a not unreasonable timidity at tackling a mining venture based on such low-grade ore and requiring so much capital to place it on its feet. Clement might have helped to dispose of an interest on advantageous terms in London, but that possibility was spoiled by his resignation.

In 1901 Clement went to Mexico; so did Gemmell. From Mexico, Clement wrote to Wall occasionally, assuring him of his continued interest in the mine at Bingham. He had an idea of persuading Volney Williamson of Spokane to join him and Wall in developing the big prospect. Meanwhile De Lamar retained the quarter interest that he had bought for $50,000 in 1899, and it was necessary to get him out. Thereupon Wall told Clement that if he would buy out De Lamar for $100,000, he would sell a quarter to Clement for $50,000, provided the property was incorporated and sufficient capital raised for development and equipment. De Lamar's quarter-interest worried Wall; it spoiled his sleep. He obtained an option on it for 90 days at $100,000, but nothing came of that. An injunction obtained by Clement forbade delivery by the bank. Clement died at Saltillo, in Mexico, on April 26, 1903. I record the fact regretfully even 15 years after.

Now comes another turn of events. Mr. Jackling had taken part in the tests made for De Lamar on the 'porphyry' ore in 1898 and 1899; he had written the report that summarized the results of those tests and of the accompanying examination of the mine itself. At that time, however, he was junior to Cohen and Clement. He was then only 30 years of age, but he had already proved himself a capable and resourceful metallurgical engineer, and he had repeatedly advised De Lamar that the Bingham venture was full of promise. A masterful character, possessed of strong initiative, starting life poor and without friends, but a graduate of the Missouri School of Mines, he was beginning to feel his way to his natural position as a captain of industry. He realized that to turn Wall's prospect into a profitable mine it would be necessary to spend much money, at least $3,000,000; and in those days, before any of the low-grade 'porphyry properties' had been proved a basis for successful exploitation on a big scale, it was almost impossible to engage the attention of capitalists in such a venture.

Before proceeding with my history, I will give instances to corroborate this last statement. My friend James W. Neill, now in the far North-West of Canada, told me the following story a few months ago: "One day, in 1897, Colonel Wall came to my office at Salt Lake City and said to me: 'Jim, I have a copper mine,' and I said 'Colonel, where is it, and how big is it?' He said, 'It's in Bingham, and it's a mile wide and as long as a railroad, and it's got more copper in it than the Anaconda had at surface.' I said, 'Colonel, that's easy; the Anaconda had no copper at the surface.' Later Col. Wall gave me an option on his three-fourths interest in his claim, the chief of which were the Dick Mackintosh and Charles Read, and I also had an option on the entire holdings of what is now the Ohio Copper Co., then the Cook group. I offered these holdings to Benjamin Guggenheim, in New York. He referred me to his engineer, Hermann A. Keller. The answer that I got to my representations that there was a mass of ore there, as shown by the tunnel on the Dick Mackintosh claim, which ran 2¾% copper, was that the tailing from the Parrot mill, at Butte, which had been under Keller's charge, ran as much in copper, and he couldn't see where he could make any money on that class of ore; so, naturally enough, my proposition was not attractive."

Mr. Cohen tells me that he submitted the business to

the late Benjamin Guggenheim in 1900 and to Charles A. Coffin, of the General Electric Co. in 1902, with his own report stating that the mine showed 18 million tons of 1.6% ore, concentratable in the ratio of 15:1. In 1903 he presented the deal to John Hays Hammond, shortly before Messrs. Penrose and MacNeill took hold. In the same year L. C. Trent had an option and offered it to the Tharsis Sulphur & Copper Co., of Glasgow, Scotland. Colonel Wall tells me that an engineer named Wilson examined the property for Marcus Daly in 1901, and that Joseph Clark visited Bingham in 1902, becoming so favorably impressed as to ask if he might submit the project to his brother, Senator W. A. Clark; but nothing happened. The fact that a mass of 1½ to 2% copper ore was unattractive 15 to 20 years ago should surprise no one; it required constructive imagination of no common order and unusual financial courage to undertake the large-scale exploitation of such a deposit at that time.

To return to our story: Soon after the last examination of Wall's property, in the summer of 1899, Mr. Jackling resigned from Capt. De Lamar's employ and went to Republic, in Washington, where he designed and built a mill for Clarence McCuaig and other Canadian capitalists. In 1901 he went to Colorado Springs and became associated again with Charles M. MacNeill and his other former employers, now his friends, as consulting engineer to the United States Reduction & Refining Co. At the very start of his career, at Cripple Creek in 1894, he had made the acquaintance of MacNeill and also of Spencer Penrose and Charles L. Tutt, these three being the organizers of the U. S. Reduction & Refining Co., which operated two big mills at Colorado City, close to Colorado Springs, on ore coming from the mines at Cripple Creek. For this company Jackling re-built and managed the Bartlett zinc-pigment plant at Canon City in 1902. Meanwhile he had not forgotten the Wall property at Bingham. He spoke about it to his friends in Colorado and they undertook to back him; so, at the close of 1902, just before Christmas, while at Salt Lake City on other business, he called upon Colonel Wall and asked him for an option, but without success. It happened that both Jackling and Cohen were in Salt Lake City in connection with a suit brought by De Lamar over the interpretation of an electric-power contract made during the time when they were in the Captain's employ; so they met. Jackling discussed the Wall property with Cohen and stated to him that if he could persuade Wall to grant an option he (Jackling) could get his Colorado associates to provide the capital necessary to develop the enterprise. Cohen went to Wall and spoke of having New York friends that would be willing to find money for the Bingham property if Wall would give a reasonable option. Wall was willing to sell half of his holdings for $400,000, but he imposed conditions covering the equipment and development of the mine; and he demanded that a mill to treat 500 tons daily be built by the supposed New York buyers, who also were first to purchase De Lamar's quarter. The negotiations broke down until Cohen obtained the help of the Salt Lake banker, William S. McCornick, who aided Cohen in persuading Wall to come to terms. The result was that on January 23, 1903, Wall signed an option to Cohen on "two-fourths undivided interest" at $350,000 in cash, of which $50,000 was payable on March 9 and $300,000 on June 7 of that year. In this agreement Wall recorded his willingness to join in the organization of a stock company, retaining the right to nominate one member of the governing board. Cohen took the option to Jackling, who took it to MacNeill, in Colorado. Thereupon MacNeill, Spencer Penrose, and his brother R. A. F. Penrose, came with Jackling to Utah and visited Bingham. Cohen's agreement was replaced by a new one, in the name of Spencer Penrose. By the terms of this new deal Wall was to receive $385,000 for 55% of the entire property and the MacNeill-Penrose group was to buy De Lamar's quarter, leaving Wall with a 20% holding in both shares and bonds. The option was for six months, with the privilege of an extension for twelve months more on payment of $5000 in cash for each monthly extension of time. They did use seven months extra and for that they paid $35,000, so that Wall eventually received $420,000 in all. They bought De Lamar's quarter for $125,000.

R. A. F. Penrose selected F. H. Minard to examine the mine. Mr. Minard's report is dated April 23, 1903. It is of particular interest to me because in 1899 he was my assistant in the examination of the Camp Bird mine, another famous bonanza. Mr. Minard brushes aside the non-essential geologic features, and places his finger on the dominant fact that the 'porphyry' has intruded into the limestone and quartzite, and that "with the exceptions noted on the north and east, the entire property is in the porphyry, and it is this formation which carries the copper." He says: "Copper occurs in this porphyritic formation in small particles of iron and copper pyrites which are very finely disseminated through its entire mass." He states that Bingham canyon has been cut, by erosion, through this copper-bearing intrusive mass, so that exploratory work, by means of tunnels aggregating 2500 to 3000 ft. in length, has afforded facilities for sampling. His samples were taken with hammer and moil, at intervals of 10 ft. "Each section was stripped and cleaned of all loose rock and copper stains, and the sample taken of the hard fresh rock, avoiding all seams or veins of ore. The cuts were made up both sides of the tunnel and across the top, and each sample weighed 50 pounds, and some of them heavier. These samples were all sacked and sealed immediately after taking; they were then dried and broken to the size of almonds and quartered twice, then broken to the size of small peas and quartered, making duplicate samples, one of which was sent to Colorado City, and the other to Canon City for analysis." Mr. Jackling was stationed at Canon City, Colorado, at that time. The assay-plan showed a zonal occurrence of the copper, as also did the two previous samplings of the property. "All the maps," he says, "show that there is a distance of low values for about 50 ft. from the portals, then they rise rapidly on going farther into the hill and maintain a high average to a point 260 ft. in, and beyond that point they

fall to an average which is between the first low and the succeeding high averages, showing conclusively that, following the contour of the hill for a distance of 50 ft. and normal to the slope of the hill, there is a zone of the porphyry which has been leached, and the value of the copper contents is not over 0.75%; that immediately below this leached zone is another zone which has been enriched, that is, the copper which was leached from the top zone has been carried down by the water and re-deposited in the zone below, and enriched the original rock which formerly carried only the same percentage of copper as is now contained in the zone below the enriched one. This enriched zone averages 2% copper and extends for 100 ft. below (normal to the slope of the hill) the leached zone. This enriched zone is a little thicker—probably 150 ft.—at the bottom of the canyon, as is shown by the horizontal distance on the maps showing the drill-holes. These holes were sunk near the bottom of the canyon. This is due to the constant tendency of the water to gravitate toward this level, making a larger quantity [of ore] here than on the sides. Another and equally important proof of this enriched zone, is the occurrence in the same horizon of high values of the well recognized secondary minerals of copper, namely covellite and bornite. The zone of material below the enriched horizon is the original rock unaltered by surface erosion or leaching, and averages 1.1% of copper, and constitutes the bulk of the deposit."

I give Mr. Minard's own words because it is well to place them on record. He recognizes a leached zone that reaches for 50 ft. from the surface, and within this zone the monzonite averages 0.75% copper. Next comes a zone of enrichment, 100 to 150 ft. thick, within which the copper abstracted from the surface zone has been precipitated upon the primary deposit, raising the copper content to 2%. Underneath the zone of secondary enrichment is the primary deposit containing 1.1% copper.

The average of all his samples was 1.6%, this being the average of the two upper zones, namely, those of leaching and enrichment. He did not estimate any ore below the zone of enrichment nor did he include any ore above the level of the creek, but only for 300 ft. above the creek, for 150 ft. at right angles to the hill-slope, and for 1600 ft. north and south. Thus he concluded that it was "reasonable to suppose" a mass of 9,000,000 tons of 1.6% ore available.

The only obstacle to success was the possible insufficiency of water to treat this ore by concentration. He considered that at least 2000 gallons was required per ton of ore treated, and referred to two possible sources of supply. The last paragraph of the report is as follows: "The property in question has excellent merit, but one cannot be enthusiastic over it on account of the water problem. There is no doubt as to the existence of the ore, under the conditions already noted, which can be readily and cheaply mined, and if the water supply can be satisfactorily determined I would recommend the erection of a 200 or 300-ton plant, to make extended experiments covering a period of at least a year, only upon the condition that you can acquire an interest in the property for the building of this plant without any payment whatever. It would also be advisable to acquire at the same time an option on the remaining interest. You would then be in shape to further develop the property, keeping constantly in mind the distribution of the ore along the lines as explained in this report."

The samples taken by Mr. Minard were shipped in duplicate to Canon City and Colorado Springs, where, after re-sampling for assay, they were collected and forwarded to the mill at Colorado City, to be subjected to a concentration test, which confirmed the results obtained in the stamp-mills at Bingham.

On June 4, 1903, a company was organized, called the Utah Copper Company, under the laws of Colorado, the capital being $500,000, in shares of $1 each. On July 1, 1904, there followed an issue of $750,000 worth of 7% bonds to run for three years and convertible into stock at par. These bonds were largely underwritten by the promoters themselves, for the Colorado group had made a good deal of money at Cripple Creek and 'Dick' Penrose, the distinguished geologist, owned a third of the Commonwealth mine, at Pearce, Arizona, which had yielded several million dollars in profit. Here I may mention that $250,000 was all the cash that was put up at the start in order to launch the Utah Copper enterprise. Colonel Wall was left with $150,000 in bonds as his share, and from the remaining proceeds of the bond-issue the promoters were enabled to pay Wall the purchase price, besides a 5% commission due to Cohen and Jackling. They still had to find the working capital—several million dollars—required to develop and equip the mine on an adequate scale. In the summer of 1904 the purchase of a block of stock was considered by, among others, the General Electric Company, for whom D. M. Riordan, assisted by E. Gybbon Spilsbury and W. Lawrence Austin, made an investigation, and reported favorably. Mr. Spilsbury's measurements showed that there was "at least 5,000,000 tons of 1.98% copper ore developed." He says† that the Copperton mill "had been brought to the point of profitable operation, the profits based on 13c. copper amounting even at that time to 70 cents per ton of ore treated." These estimates of Mr. Spilsbury fully corroborated the earlier figures of Messrs. Jackling and Minard; nevertheless they were received with skepticism not only by his own clients but by others that heard of them; indeed it was insinuated, so he tells me, that he had succumbed to the undue influence of Messrs. MacNeill and Penrose! However, when the business was heartily recommended by Mr. Riordan, on the strength of Mr. Spilsbury's report, to the directors of the General Electric, they seemed inclined to close the deal, until one of them remarked that he did "not believe the damn figures." That undoubtedly was the mental attitude of many others to whom the business was presented. Meanwhile an experimental plant of 300 tons capacity—called the Copperton mill—was built at Bingham. It was completed in April 1904. Shortly after-

†In a letter to the writer.

ward Messrs. Penrose and MacNeill bought De Lamar's surviving interest of one-eighth and re-organized the company, this time* incorporating in New Jersey with a capitalization of $4,500,000 in $10 shares. In 1905 the capitalization was increased to $6,000,000. In this year the Denver & Rio Grande Western railroad extended its line from Bingham to the mill-site at Garfield. The Bingham & Garfield railway, controlled by the Utah Copper Company, was not completed until August 1911. In 1906 the remainder of the original bond-issue of $7,500,000 was retired, at a premium of 5%, in order to clear the way for a new issue of bonds, namely, $3,000,000 at 6%, this money being required to build the Magna mill, at Garfield. The bond-issue was underwritten by the Guggenheims, in the name of the Guggenheim Exploration Co., and they, at the same time, acquired a block of stock. In January 1908, after the panic that marked the close of 1907, Hayden, Stone & Co. underwrote the purchase of a block of stock ($1,500,000), this stock being sold in order to provide funds for expanding the capacity of the mill. Thus the capitalization of the company was augmented to $7,500,000.

Two years later, in January 1910, the capitalization was increased to $25,000,000, of which $16,244,900 in $10 shares has now been issued. Out of the stock issue, amounting to $8,282,240, made in 1910, the sum of $3,100,000 was paid for the property of the Boston Consolidated, and $4,455,120 for 1,000,152 shares of Nevada Consolidated, the latter being a highly successful copper enterprise at Ely, Nevada. From the day when production began, in 1907, to the end of 1917, the mine has yielded 67,220,700 tons of ore, averaging 1.428% copper, producing 3,118,385 tons of concentrate, averaging 19.81%, and containing 617,785 tons of copper, enabling the company to pay $75,770,882 in dividends and accumulate a working capital of $30,285,889.

Colonel Wall was elected a director of the company when it was organized in 1903, but he resigned in 1908, owing to friction with his colleagues on the board. The result was to create bitter feeling between him and Mr. Jackling, a feeling that found vent in a journalistic vendetta, for Wall started a paper called 'Mines and Methods', which was published at Salt Lake City and under the not too scrupulous editorship of Claude T. Rice waged bitter war against Jackling and his associates from September 1909 to August 1913, when it ceased to appear. This animosity was due, as far as I can learn, not to personal wrong but to intense disappointment, on the part of Colonel Wall, in not being made manager of the company and in seeing the credit for the creation of the enterprise pass to Mr. Jackling, whose virile personality increasingly dominated the operations. One cannot withhold some measure of sympathy from the old miner, who stuck to his dreams so long and showed such patience in consolidating the property first, and then in nursing it during the long years that passed before his dream came true; but such sympathy is not inconsistent with admiration for the persistence and ability of the younger engineer, who, with equal faith in the prospect, brought the dream to fulfilment.

(To be Continued)

*On April 29, 1904.

Production of Quicksilver

Quicksilver production in the United States during the first half of 1918 was 17,576 flasks, according to F. L. Ransome, of the U. S. Geological Survey. The total in 1917 was 35,954 flasks, and as one-half of this is 17,977 flasks, the quantity thus far produced this year falls short by 401 flasks of that which should have been produced if the output this year is to equal that of last. As quicksilver, if not absolutely essential to the conduct of war, is a metal for which it would be exceedingly difficult to find satisfactory substitutes in all of its uses, and as an output of 36,000 flasks would, it is estimated, be barely enough to meet the demands in this country in 1918, the shortage indicated by the returns for the first half of the year calls for energetic efforts by the producers, the consumers, and the Government to increase the supply of the metal and to curtail less essential uses. With the enlargement of our Army the demand for quicksilver is likely to be considerably greater in 1919 than in 1918, and the perfection of satisfactory detonators for high explosives that shall contain little or no mercury is one of the urgent problems of chemistry as applied to war.

The decline in production during the first half of 1918 was due chiefly to the shortage and the increased cost of labor, and to the exhaustion of depletion of known orebodies under the stimulus of high prices for the metal. The practice at some of the larger mines has been to devote nearly all energy to getting out ore and to postpone underground exploration and development that are necessary to insure long-continued steady production. In the language of the miners, some of the mines have been 'gutted,' and considerable time will be needed to restore them to a condition of high productivity. On the other hand, the high price of quicksilver has not led as extensively as had been hoped to the re-opening of old miles long idle, although there are some notable examples of this result, and, during the second half of the year, these re-opened mines may make good the shortage. Quicksilver mining is full of uncertainties, and capitalists are slow to invest extensively in an undertaking whose future can be so little foreseen. There is opportunity here for patriotism to cast the deciding vote where the cold doctrine of chances might turn the investor to industries offering greater assurance of reward.

One of the notable achievements in the industry during the year has been the successful adaptation of the rotary cement kiln to quicksilver metallurgy. Eight of these furnaces are now or will soon be in operation in California, and they are expected to make an increase in production that may more than offset the falling off during the first half of the year.

The average monthly prices ranged from $128 to $112, or about $115.84 per flask for the six-month period.

Process for Recovering Platinum

By V. J. ZACHERT

Though the occurrence of platinum has been reported from many localities in the United States, little actual increase in production has resulted. The Western placers produce a few hundred ounces annually as a by-product; and this comes, more by accident than by design, in the course of gold-dredging and other forms of alluvial mining.

The platinum in these alluvial deposits is found in small scales or flakes, from one-eighth inch in diameter down to minute particles hardly visible to the naked eye. These flakes have a tendency to evade capture in the ordinary miner's sluice, so that a large part of this platinum has been carried in suspension to the tailing-dump. In the operation, after passing a large quantity of gravel over the riffles in the sluice, some of the larger flakes of platinum are retained with the other heavy concentrates and remain there until the clean-up, but the finer flakes, which are most abundant, are too light to resist the 'boil' in the riffle, and are lost.

As the preponderant amount of platinum in these placers is in the form of minute scales and an efficient method of saving it is of vital importance, some means other than gravity-concentration must be employed. The most feasible and economic means of saving all the platinum of these placers is by some arrangement to produce a rough concentration only, for the purpose of reducing the bulk by eliminating the coarse material and part of the valueless sand. Thus sand-concentrate can be produced averaging 75c. to $1 per ton, which would contain most of the platinum and other precious metals; and then subjecting this product to a further treatment.

An efficient apparatus for producing the low-grade platinum concentrate is the Neill jig, which is in successful operation on a number of gold-dredges in California and elsewhere. Though this jig is capable of saving the platinum in a low-grade sand-concentrate, the problem is to recover the platinum from this jig-concentrate efficiently and economically.

At the present time the means used is a shaking-table of the Wilfley type. This produces a high-grade concentrate, which can then be shipped to some refinery. It is unnecessary to discuss the ineffectiveness of separating fine platinum by simple gravity-concentration; exhaustive trials have proved it to be impracticable from a commercial point of view. A method by which the platinum will be separated in the form of crude bullion on the spot is the means upon which we rely for an increase in the production of platinum from our Western placers.

I present a method, discovered by myself, after experiments to ascertain the reason why metallic grains of platinum amalgamate with mercury only when the mercury is alloyed with sodium, and why, as soon as the sodium is spent, the platinum again leaves the mercury. When placing sodium amalgam in water the sodium immediately commences to decompose; the oxygen of the water combines with the sodium and forms sodium oxide, which dissolves, while the hydrogen escapes as gas. This chemical decomposition creates an electric current flowing from the electro-positive metal sodium to the electro-negative metal mercury. If the current is powerful some of the dissolved caustic soda in the solution is again deposited as metal on the mercury, and if a piece of platinum be placed upon the mercury it instantly will be plated with metallic sodium and the mercury will then envelop it; but if this amalgamated piece of platinum be placed in a glass of water the platinum will leave the mercury, as there is an insufficient quantity of sodium in the mercury to create the necessary electric current for its re-deposition. The reason why sodium amalgam has never been successfully applied to recover platinum in placer mining is that this function is not generally understood, and also the consumption of sodium caused by its decomposition in the water is prohibitive. In fact, it costs many times more than the value of the platinum recovered by its use.

I next proceeded to devise a means for producing a coating upon the surface of platinum that would remain permanent. Copper in solution as sulphate appears to be the most suitable metal for producing this coating upon the platinum, and zinc, mercury, and sulphuric acid serve as the means for generating the electric current. As these reagents, however, would be costly if used in large quantities when treating sands for the recovery of platinum, I determined the least amount of these reagents that could be used to obtain the desired result, step by step reducing the quantity of reagents until the limit was reached with a solution containing 0.05% copper sulphate and 0.05% sulphuric acid.

In practice the following procedure was found to give good results. Prepare a solution containing one pound of copper sulphate and one pound of commercial sulphuric acid, by dissolving the contents in 2000 lb. of water; the function of this solution is to serve as the electrolyte for creating the electro-chemical action when passing over the amalgamating plate with the platinum-bearing sand. On an ordinary amalgamating plate of standard dimensions sprinkle a little zinc amalgam (prepared by pouring molten zinc into a quantity of mercury and, on cooling, reducing it to powder in a hand mortar); or this powder may be fed periodically in small quantities into the sand-hopper so as to become thoroughly mixed with the sand before it approaches the amalgamating plate, thus producing a more uniform distribution.

In operation the platiniferous sand is fed from the hopper with the prepared electrolyte to the amalgamating plate; on its progress over the table the platinum and other precious metals present are seized by the mercury and firmly held, while the barren sand passes off as tailing; the electrolyte is pumped back into the storage tank and used again. It is remarkable to observe the avidity with which the platinum and the metals of its group will amalgamate by this method. Fully 90% of the metals remain as a spongy mass of amalgam on the first six inches at the head of the plate, while hardly a trace could be found at the foot. This method of recovering platinum and other precious metals is efficient and inexpensive. Consequently it allows the treatment of a large tonnage of low-grade platiniferous sand economically, and crude bullion, instead of concentrate, would be available to send direct to the Mint.

This method can be used also in estimating the platinum content in material too low in grade for reliable results by assay. The quantity of material that is usually taken for assay is so small that the sample must be quite rich in platinum to give reliable results. At this time, when platinum is so high in value, even the most careful and refined manipulation will fail to indicate an amount of platinum in a product that would have a market-value of 75c. to $1 per ton. In making a determination for platinum by this method, place 10 lb. of the sand in a gallon bottle, with one pound of mercury to which has been added 10 gm. of zinc amalgam. The electrolyte can be prepared by dissolving in 2000 cc. of water 1 gm. of copper sulphate and 1 gm. of sulphuric acid, then gently roll the bottle for 10 minutes. Then discharge the contents of the bottle into a pan and remove the sand by panning. The remaining mercury is squeezed through a chamois skin, the amalgam retorted, then the residue fused with a little borax in a scorifier, cupelled, and weighed.

There is a great deal more platinum in the alluvial deposits in the western part of the United States than is generally supposed, but its presence is difficult to determine without special efforts; first, because the quantity per cubic yard of gravel is not large, and, secondly, because of the illusive character of these minute flakes of platinum when associated in the pan with chromite, magnetite, and the other iron-bearing minerals composing the 'black sand' that also possess a metallic lustre when wet, and an observer is unable to be sure of the presence of platinum in the sample. I have tried this method with successful results also on a sample of platinum ore from British Columbia, and on concentrate from the Rambler mine in Wyoming. The latter must be given an oxidizing roasting before it can be subjected to the amalgamating process for the recovery of the platinum.

CHROME PRODUCTION of Rhodesia, east-central Africa, accounts for 50% of the world's total. In 1916 that country exported 62,000 tons. The 'African Herald' of August 31 states that Peake brothers have 2,000,000 tons of high-grade chrome in the Umvukives. This was discovered a year ago, since when considerable development has been done. Over 300 samples averaged 53% Cr_2O_3. There is also 1500 acres of chrome-bearing soil of good grade. A survey has been made for a railway 30 miles long from Banket Junction. It is estimated that the ore can be delivered at Beira, on the east coast, for $8.50 per ton.

Carbocoal

*One great advantage of the carbocoal, as compared with other forms of fuel, is that brought about by the formation of the semi-carbocoal at a low temperature. When coal has been coked at a low temperature and allowed to cool, it will no longer soften and continue the process of coking when again heated. The character of coke so formed is entirely different from that of coke made at a high temperature. It probably occludes more oxygen, and is more readily acted on by the oxygen of the air, and probably burns with less excess of air than is required for burning other fuel. One interesting factor is the marked reduction in the formation of clinker, as compared with the coal from which the carbocoal is made; this is hard to understand. The carbocoal will naturally carry more ash than the coal from which it is made, but owing to the uniform grinding and mixing, the ash is distributed uniformly, and probably every particle of the ash is covered with a layer of soft coke in the initial coking. This may have some effect in reducing the tendency of the ash to clinker, and may enable it to drift away from the zone of highest temperature before it becomes so fused as to give trouble. In addition to its value for ordinary gas-producers or Mond gas-producers, the carbocoal should have special value in connection with suction gas-plants. The wider adoption of such plants has been retarded by the difficulty of securing adequate supplies of suitable fuel. While carbocoal undoubtedly can be used for steam purposes, it looks as if it would have much greater value in the domestic trade, where it could take the place of anthracite. One of the difficulties in the production of large amounts of ammonia from coke-oven gases has been the apparent limit to the demand for coke; but the demand for such a material as carbocoal will be far more extensive, and it is not unreasonable to expect that in time a large amount of nitrogen compounds, so greatly needed in agriculture, will be derived from this source.

ZINC FERRATE is produced when blende is roasted at too high a temperature. The chief difficulty in obtaining a good extraction of zinc in leaching the calcine is eliminated by careful attention to this detail so as to reduce the proportion of that insoluble compound. Thomas French asserts that there is no difficulty in obtaining 90% extraction from zinc ores assaying as high as 15% of that metal and 25% iron, and roasted zinc concentrates may be counted upon to yield as much as 95 to 97% of the zinc on treatment with sulphuric acid.

*Abstract: Discussion in Trans. A. I. M. E. by Charles Catlett.

Colloids in Flotation

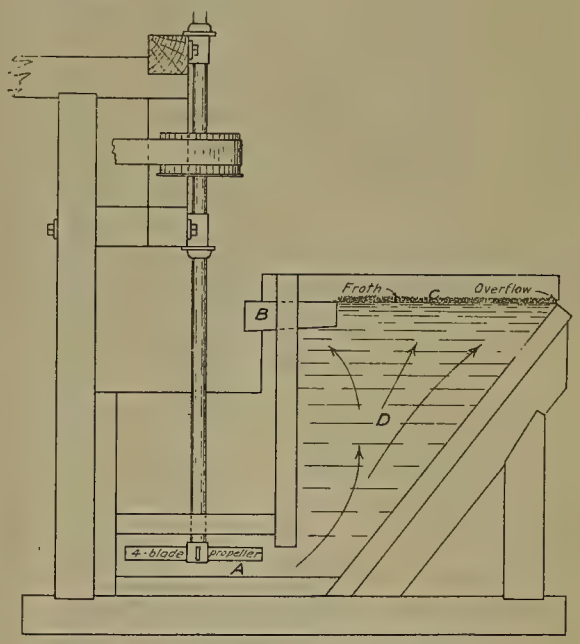
By JACKSON A. PEARCE

The very fine amorphous material in crushed ore usually spoken of as colloids or colloidal matter seems to have escaped the professional discussion usually accorded to a subject of such importance. If metallurgists generally are giving the subject serious consideration they are not giving to the profession their due share of the findings, whether positive or negative. Now and then brief notes on the agglomeration of colloids by acids or alkalies find their way into print leading us to believe that such colloids are troublesome, while others maintain emphatically that without colloids flotation is impossible. My own experience has been that colloidal matter in flotation is a nuisance, and worthy a systematic investigation by those in position to make it.

Several years ago I was called upon by a custom-mill in Clear Creek county, Colorado, to adapt flotation to the general run of ores in that district. After spending several weeks in useless endeavor to find an oil adapted to the ore on which we were working, I made a series of changes in the machine itself. One day, after weeks of discouraging work, we made an alteration that necessitated an empty machine. Upon starting after the alteration we were surprised to get an excellent froth, heavily laden with sulphides. This was the first genuine flotation any of us had seen, and the event elicited congratulations from the staff. I passed the cigars around as befitted an occasion of such importance and of such felicity, and as we watched developments we smoked. Soon we had occasion to regret both congratulation and cigars, for there was a gradual increase in the volume of froth, and as the volume increased the sulphides decreased. At the end of two hours we had more froth than we could handle—and no mineral.

This action of the machine led me to correlate certain other data that had come under my observation, the importance of which I probably would have recognized sooner had I not been led to believe that each ore required a certain oil, to find which was the supreme and ultimate duty of the flotation metallurgist. Several times before, I recalled, the froth was slightly better immediately after starting the machine. At other times, when the machine was at its worst, throwing off barren froth in such abundance as to require the efforts of two men to sluice it into the river, I would take samples of the feed and try them with different oils in the testing-machine. Although several oils gave good results in this machine, none of them worked well in the big plant. I recalled also that some time previously, in making flotation tests on cyanide-tailing, 85% of which would pass 200-mesh, I could get no mineral-bearing froth until a large part of the colloidal matter had been removed. Now, the machine in use was of a well-known type with bottom-discharges regulated by valves. There were openings in the partitions of the froth-cells to assist in equalizing the pulp-level in these cells. The bottom-discharges favored the elimination of the coarse material while the back-flow through the partition-openings favored the accumulation and retention of the fine material, thereby increasing the proportion of colloids within the machine. With all these data correlated it looked as though the colloidal matter exercised considerable influence over flotation.

Assuming it was the increase in colloidal matter that



MACHINE FOR DECREASING THE EFFECT OF COLLOIDS IN FLOTATION

prevented flotation, I proceeded to alter the machine so as to prevent its effect as far as possible. Closing the holes in the froth-cell partitions to prevent the back-flow, raising the openings between the agitation and froth cells to get a better circulation of slime, and many other minor changes all of which contributed, I was able to get a better recovery than I had expected. However, it soon developed that many ores could not be treated successfully even with the improved conditions, and that it was necessary to discriminate carefully in the purchase of ores. This limited the field of operation, a serious handicap to a custom-mill.

Later on, still adhering to the supposition that colloidal matter was the source of our trouble, I designed a machine to reduce its effect. The accompanying sketch

shows a cross-section of the new machine. In the figure, *A* is the agitation-cell. The pulp is forced up through the froth-cell *D*, overflowing at *B*, while the froth collects at *C* and may be removed in the customary way. The advantage of this type of machine is that with an upward circulation of the pulp in the froth-cell and a discharge wholly at the surface, the coarser or granular material tends to remain behind, while the lighter or colloidal matter passes forward in preference. In this way granular material will accumulate within the machine. Eventually an equilibrium is reached where the composition of the overflow practically is the same as the feed, yet the proportion of colloidal matter within the machine itself is much less than that in the original ore.

It may be interesting to know how this machine, devised on theory, worked out in practice. A 24-in. six-cell machine of this type was built, in size and cells the same as our old machine. For several weeks we ran the two in parallel, treating not one ore but many ores. The net result was strongly in favor of the new machine. Based on the feed to the machines, the new machine showed an average increased recovery of 19.8% of the gold, and 27% of the silver. Incidentally, the consumption of power dropped from 6.5 to 1.8 hp-hour per ton of ore. In the third day of this test with a high-grade silver ore the new machine showed a net gain of $322. The assay from which this figure was obtained was confirmed by panning the tailing. Later work showed that while this increased recovery was maintained on the general run of ores, on two ores the difference was little, both machines yielding a high recovery. The success attending these tests led to the installation of another machine to replace the old one and also to less discrimination in the purchase of ores.

Notwithstanding our success with the general run of ores, we received two or three that gave that direful voluminous barren froth. On these ores we were able to make a fair recovery by treating the slime and re-ground sand separately. The separation was made in a Dorr classifier preceding table-concentration. After table-concentration the re-ground sand was sent to one machine, while the slime, after table-concentration, was sent to another machine. The recovery on the sand-machine was good, and as the sand amounted to about 70% of the whole, the total recovery was fair; also by placing a small thickener between the slime-tables and the slime-machine, and maintaining a heavy overflow we were able to wash away a sufficient amount of the colloidal matter to permit a fair recovery on the remainder. The slime thus sent to waste was of higher assay-value than that of the original ore, but it was of limited tonnage. At any rate, it was more economical to discard some and recover the remainder than to treat it all and recover nothing.

I carried out a number of experiments on other ores to show the relative importance of treating the sand and slime separately and together. While the tests showed no pronounced advantage in treating sand and slime together, owing to the unfavorable conditions under which they were carried out, I have a suspicion that a higher recovery can be made on some ores by treating the sand and slime together. With most of our ores it was better to treat the sand and slime separately, and with a few it was imperative. Treating ores from so many different mines, I found it safer at all times to keep the sand and slime separate.

With these machines to increase the proportion of granular material, or rather to decrease the proportion of colloidal matter in the treatment of all ores, and with a small thickener for the elimination of colloids from some ores, our field of operations was greatly increased, in fact, it was more than doubled, and justified the company in the acquisition of another mill. During last year we treated ores from 95 different mines scattered over a distance of 20 miles. This statement would not convey much meaning if applied to the Mother Lode or to the Rand, on account of the similarity of the ores of the different mines in those districts, but here a different mine means an ore essentially different both as to matrix and valuable minerals. Here we find as great a difference in the ores of adjoining mines, or of different ore-shoots in the same mine, or of different levels in the same ore-shoot, as one would expect to find between the ores of Modderfontein and Tonopah. Aside from oxidized ores, little or no discrimination was made in purchasing. We successfully treated ores assaying as high as 133 oz. silver per ton; gold ores as high as 5 oz.; lead ores up to 40% lead; copper up to 10%; and zinc ore of varying qualities. Two or three times during the year we received ores from which no saving could be made on the slime-machine. The sand-machine worked well at all times.

We had two mills in operation, a stamp-mill, with a pebble-mill for re-grinding, and a mill equipped with crushers, rolls, ball-mill, jigs, tables, etc. In the stamp-mill from which the above data were taken, the ore was crushed to 16-mesh before the separation of slime was made. In the other mill the ore was crushed to 3½-mesh and the slime separated. It is interesting to note the behavior of the re-ground products when subjected to flotation. Crushing to 16-mesh before separating the slime, the re-ground sand gave very little froth and no large bubbles, but every small bubble was thoroughly saturated with sulphides. As the sulphides in the ore diminished to the vanishing point the froth likewise decreased, in consequence of which some ores gave nothing in the way of froth. On the other hand, when re-grinding the 3½-mesh sand the froth was at all times voluminous, consisting of a mixture of both large and small bubbles and sometimes was barren even in the presence of abundant sulphides. It was shown in the course of time that an ore crushed to 16-mesh before separating the slime therefrom might yield well to flotation, whereas the same ore crushed to 3½-mesh and the slime separated before re-grinding might yield nothing, although this was rare.

I may be wrong in the supposition that the proportion of colloidal matter within the machine has a decided influence over flotation, but on that assumption I have been

successful with these ores. The argument for this method of treatment seemed to be sufficiently novel and well founded to justify the Patent-Office in allowing a process patent. This accumulation of colloids within the machine might also explain why, in places, some machines must be emptied periodically to maintain a good recovery.

The reason for this I cannot explain, and there is no necessity for obscuring the results of operation by citing the theories already advanced, no one of which is generally known or well established. All the data I have given seem to sustain this argument. Cyanide-tailing was not amenable to flotation until a large amount of colloidal matter had been removed. Our flotation machine passed gradually from an excellent froth to a barren froth as the back-flow of the machine increased the proportion of colloids therein. The machine with its increased colloids gave no mineral-bearing froth while a sample of the feed without additional colloids, treated in a single-cell machine, gave a good froth. Crushing to 16-mesh would liberate a larger proportion of colloidal matter for separation than crushing to 3½-mesh, hence the difference in behavior of the re-ground products. Eliminating colloids by means of a thickener increased the recovery in some instances.

The absence of all or nearly all colloidal matter might end most of our flotation troubles. Unfortunately this is not always feasible economically, as in some instances such colloidal matter constitutes a large part of the ore and may be sufficiently impregnated with valuable minerals as to render its elimination wasteful. I have noticed that on some ores violent agitation would yield no satisfactory result, whereas the same ores moderately agitated would yield a good recovery, and in some cases the mild cascade action gave the best result. On the other hand, some ores require violent agitation, showing clearly that flotation is sensitive to mechanical changes. My experience has been that the mechanical treatment of colloidal matter is far more encouraging than its chemical treatment, and to me it seems the logical field for investigation. That well-worn but misleading slogan, "an oil for every ore," might be more appropriately rendered, "a machine for every ore."

Invested Capital

One of the chief stumbling-blocks in equitable administration of the excess-profits tax has been the definition of 'invested capital,' says the 'Boston News Bureau.' At the hearings before the Ways and Means committee it was suggested that the following definition be substituted for that contained in the present law:

(*a*) In the case of a corporation or partnership:

(1) The actual cash value of all the tangible property of the corporation or partnership, including mines and mineral deposits, as of March 1, 1913, if such property was acquired prior to said date; or, if acquired on or after said date (*a*) the actual cost thereof in money; or (*b*) the actual cash value, at the time of payment, of tangible property other than cash paid thereof; or (*c*) if otherwise acquired, the actual cash value thereof, at the time of such acquisition; and

(2) Paid-in or earned surplus and undivided profits acquired on or after March 1, 1913, used or employed in the business exclusive of undivided profits earned during the taxable year.

In the argument submitted in support of the changes John R. Vanderlip and Frederick C. Stevens said in part:

"The foundation upon which the present excess-profits tax law and the income-tax law rests is, that, as between the Government and the taxpayer, a line of demarcation is drawn (on the 1st of March 1913 as respects income taxes, and on January 1, 1914, as respects excess-profits taxes), distinguishing between the period prior to the dates named, when neither of said taxes could lawfully be levied by the Government, and the period after said dates. Whether a taxpayer gained or lost in the carrying on of his business prior to the date constituting such line of demarcation is immaterial. Upon all income, gains, and profits derived by a taxpayer after the specified date, the Government has the authority, which it is exercising, to impose income and excess-profits taxes. The basis for the depletion allowance under the income-tax law, and for the deduction permitted under the excess-profits tax law, should be the actual invested capital of the taxpayer on the 1st of March 1913 and the 1st of January 1914, respectively (unless, as would seem reasonable for the sake of uniformity and consistency, the date of March 1, 1913, should be adopted for both laws).

The definition of 'capital' in a tax law cannot be abstractly accurate. The aim should rather be to make it practical. The definition, therefore, should be one in consonance with the recognized understanding and practice of business-men of the country where the law is operative. The adoption of this proposed amendment will eliminate one of the elements of complication and doubt which has produced so much confusion in the application of the law; and, as respects owners of mineral properties, will give the additional advantage of conforming the definition of 'invested capital' in the excess-profits tax law, to the basis of valuation for the purpose of depletion allowances incorporated in the income-tax law. It will also greatly simplify the administration of the law by the Treasury Department. It is therefore submitted that, for the purposes of the excess-profits tax, the actual value of the invested capital of a mine-owner, as of the first of March 1913 should be adopted as the basis for determining the amount of his earnings which shall be free from excess-profits tax. The suggested definition of invested capital, if adopted, will in large part efface the inequality in the operation of the law of which criticism is so widely heard. It will give every enterprise the exact standing as respects income-taxes that it had in the business world on March 1, 1913—a standing based upon its actual resources and not upon inaccurate and artificial standards of measurement. . . ."

Charcoal as a Precipitant of Gold

*In discussion of a paper by H. R. Edmands on the use of charcoal for precipitating gold from its solution in cyanide, W. R. Feldtmann confirms the observation that the activity of the charcoal as a precipitant is enormously increased by wet grinding, without screening. In the experiments much of the charcoal was apparently in a colloidal condition, and this influence has an important effect on the precipitating power of the charcoal.

The effect of reducing the charcoal from a coarsely granular to a finely granular condition is, as Mr. Edmands has shown, and as might be expected with such a porous substance, only a small one. The increase in precipitation due to crushing from $-\frac{1}{8}$ in. $+1/20$ in. to $-1/100$ in. $-1/150$ in. grade (the finest dust being screened out) is relatively unimportant and is certainly not proportionate to the increase in surface of the charcoal granules. When, however, by wet grinding without screening, the comminution is carried much further, a precipitant is produced of which the increased activity is so great as to be almost of another order. In making this discovery Mr. Edmands has definitely brought the use of charcoal as a precipitant for cyanide solutions within the scope of practical technology. Mr. Feldtmann carried out a few confirmatory experiments. The solutions contained only distilled water and $KAuCy_2$, equivalent to 67.2 mg. gold per 150 cc. The charcoal used was cocoanut-shell charcoal. The fine grinding was done in a Wedgwood mortar with water, for some minutes, the water used being measured and allowed for in the gold tenor given. The time of contact was 22 hours. Even with the limited amount of grinding, a considerable proportion of the charcoal became so fine as to remain suspended in the solution during the 22 hours contact. The subsequent behavior of the charcoal on filtering seemed to indicate that some of it was in a colloid state.

The precipitation results were:

	Quantity of solution, cc.	Gold precipitated, mg.
3 gm. finely ground charcoal	150	57.54
3 " " " "	300	80.40
3 " coarsely granular "	150	14.70

It is seen that the effect of even a very limited amount of fine grinding is considerable. The experiments serve to show that, owing to the difficulty in filtering finely ground charcoal, some special form of apparatus would be necessary in order to apply the precipitation process successfully. Such apparatus Mr. Edmands seems to have succeeded in devising. The increase in precipitating effect as the result of fine grinding is probably due, not so much to an increased area of granular particles of charcoal as it is to the formation of colloid carbon.

The auric cyanide salts, $NaAuCy_4$, $KAuCy_4$, and hydrogen auric cyanide, $HAuCy_4$, are scarcely, if at all, precipitated by charcoal. This is a point of considerable interest, which does not appear to have been noted previously, and only became known to Mr. Feldtmann recently. The following are two sets of tests illustrating this point. In each test 3 gm. of cocoanut charcoal in coarse pieces was left in contact with 150 cc. of the gold solution overnight:

		Precipitated, mg.
1a.	Solution containing 68.0 mg. Au as $KAuCy_2$	13 3
1b.	Solution containing 65.5 mg. Au as $KAuCy_4$	1.3
	Time of contact, 22 hours.	
2a.	Solution containing 67.2 mg. Au as $KAuCy_2$	10.4
2b.	Solution containing 66.6 mg. Au as $KAuCy_4$	nil
	Time of contact, 17 hours.	
2c.	Solution containing 67.2 mg. Au as $HAuCy_2$	20 7
2d.	Solution containing 66.6 mg. Au as $HAuCy_4$	0.23
	Time of contact, 22 hours.	

The relative precipitating power of different kinds of charcoal is shown below. In each of the cases cited below, 10 gm. of the freshly prepared charcoal, crushed to $-1/10$ in. $+1/30$ in., was left in contact with 200 cc. of solution containing 0.22 gm. KCN and 17.2 mg. gold per 100 cubic centimetres.

	Precipitated, mg.
Lime-wood charcoal	32.28
Birch	31.68
Larch	31.08
Laurel	28.9
Hazel	27.88
Almond	26.88
Cocoanut-shell	11.0
Bone	8.4

Although coarsely granular cocoanut-shell charcoal gives a relatively low precipitating efficiency, it is a convenient medium, and different samples prepared at different times give consistent results. Both cocoa-shell charcoal and bone-charcoal are notably denser than any of the ordinary wood-charcoals, and when used in coarsely granular form sink at once, whereas the wood-charcoals all float for at least part of the time of contact.

This method of precipitation is meeting with success in Australia.

*Abstract: Bulletin, Institution of Mining and Metallurgy.

MOLYBDENITE occurs in three definite types in the Pontiac deposits, according to a paper by E. Thomson in 'Economic Geology' for June. These are: 1. Associated with slightly more basic segregations in the granites, syenites, or gneisses, as seen in the Laurentian deposits in Pontiac county, Quebec. 2. In intimate association with pyroxene in the 'contact pyroxenite' of the Grenville series (Canada) or in the partly digested rock present where this process of silicification has been active. 3. In pegmatite dikes. The characteristic accessory minerals in the first type are fluorite and tourmaline; in the second type scapolite and titanite, along with pyroxene, but pyroxene may be abundant without any sulphides being in evidence. The second type of deposit is the more common. Pyrite and pyrrhotite are generally found accompanying the molybdenite, scapolite, and titanite. On oxidizing they discolor the rock, usually giving it a dark appearance, such as prospectors term 'burnt'.

ORE-RESERVES of the Mount Morgan mine, Queensland, are estimated as 3,825,685 tons, assaying 2.58% copper and $6.16 gold per ton.

Separating Barium From Strontium

By JOHN WADDELL

In a textbook on quantitative analysis recently published* a volumetric method is given for the determination of lead in ores, which depends on obtaining the lead as chromate, dissolving the chromate in dilute hydrochloric acid, adding potassium iodine and titrating the iodine set free by means of sodium thiosulphate. This is an extremely accurate method and duplicates should agree within a few hundredths of one per cent. In Bulletin 422 of the U. S. Geological Survey, details are given of a method for the separation of barium and strontium by precipitating the former as chromate by means of ammonium dichromate. A solution of ammonium dichromate containing 100 gm. to the litre, and another of ammonium acetate 300 gm. to the litre, are used. A double precipitation is said to be necessary to free the barium from the whole of the strontium. The barium chromate thus obtained is ignited and weighed. As the ignition of barium chromate gives some trouble, it seemed to me that it could be determined volumetrically with greater ease, provided a sufficient number of determinations are to be made to warrant the trouble of standardizing a solution of sodium thiosulphate.

The equations involved are:

$$BaCrO_4 + 2HCl = BaCl_2 + H_2CrO_4$$

$$2H_2CrO_4 + 12HCl + 6KI = 6KCl + 2CrCl_3 + 8H_2O + 3I_2$$

$$6Na_2S_2O_3 + 3I_2 = 6NaI + 3Na_2S_4O_6$$

In testing the method I observed the precautions that had been found necessary with lead. Having made a solution of 3 gm. of crystallized barium chloride ($BaCl_2 2H_2O$) per litre, I precipitated two lots of 50 cc. each, filtered in a Gooch crucible, ignited, and weighed. I then dissolved these precipitates and titrated with a sodium thiosulphate solution, of which 25.45 and 25.34 cc. respectively was required. I repeated the determination without, however, igniting the precipitates, again in two lots of 50 cc. each, requiring 25.10 cc. and 25.05 cc. of thiosulphate. Three students in the laboratory made determinations as well, and after some preliminary experimenting they obtained in succession 25.05, 25.08, and 25.09 cc.

The details of the process were as follows: To 50 cc. of the barium chloride in an Erlenmeyer flask, 10 cc. of the ammonium acetate solution mentioned above was added, the liquid brought to boiling, and while the flask was given a swirling motion, 5 cc. of the ammonium dichromate solution was added. The flask was boiled for a minute and then cooled, since barium chromate is somewhat more soluble in the heat than in the cold. The whole was filtered through a Gooch crucible, and the soluble chromate, of course, thoroughly washed out of the Erlenmeyer though the solid barium chromate was not entirely removed. The washing of the flask was done with successive quantities of cold water, to which a few drops of the ammonium acetate solution was added. When the precipitate was completely washed, it was removed, along with the asbestos, to a beaker, and part of a mixture of 25 cc. of concentrated hydrochloric acid and 75 cc. of water was used to dissolve it, and the whole was poured into the Erlenmeyer containing the remainder of the barium chromate. The rest of the acid was added, and the solution was made up to about 200 cc. Unless 25 cc. of the concentrated hydrochloric acid is used the subsequent titration will be too slow; but the acid must be diluted and must not be hot, else, by its action on the chromate, chlorine will be set free. Then, after the reading of the burette containing thiosulphate was taken, about a gramme of potassium iodide was added to the liquid in the flask. After shaking to ensure the liberation of the iodine the titration was begun immediately to avoid escape of any iodine. In order to give time for the reaction the thiosulphate should not be run in more rapidly than two or three drops per second. If four or five grammes of potassium iodide is added instead of one, loss of iodine undoubtedly would be prevented, even on standing for five or ten minutes, and the titration with thiosulphate thus could be made rapidly. When the brown color of the iodine had nearly disappeared starch paste was put in and thiosulphate added, a few drops at a time, with alternate vigorous shaking, until the blue color was almost gone. Then about 10 cc. of concentrated hydrochloric acid was added and the liquid was warmed to blood heat, in order to hasten the last stages of the reaction. A drop or two of thiosulphate usually sufficed to discharge the blue color, and then the burette reading was taken.

Among the first determinations made by the students was one intended to test the necessity of a double precipitation of barium in its separation from the strontium. To 50 cc. of the barium-chloride solution about 0.15 gm. of strontium nitrate was added, and, after one precipitation of chromate, 25.91 cc. of thiosulphate was required, whereas, after a double precipitation of the barium chromate, 23.40 cc. of thiosulphate was needed. When no strontium was present the student making this test had found that 24.50 cc. was required for the barium chloride alone. It appeared that in a single precipitation strontium, if present in considerable quantity, was carried down appreciably with the barium, and that in the re-precipitation some barium was lost. As indicated

*'Quantitative Analysis in Practice.' John Waddell. P. Blakiston's Son & Co.

above, further investigation showed that 24.50 cc. was incorrect for the barium chloride alone, but the substitution of the correct figure, 25.10 cc., would not affect the conclusion, and it was evident that something was wrong in the details of the process.

The following procedure finally was found to be satisfactory. The precipitation and filtration having been made as described, the chromate was dissolved from the asbestos while still in the Gooch crucible, by as little hot 1:1 nitric acid as would serve the purpose, alternating with hot water. The acid having been thoroughly washed out, the solution was brought into the Erlenmeyer, made up to about 50 cc., and heated to boiling. After the addition of dilute ammonia until a permanent but not abundant precipitate of chromate was formed, 10 cc. of ammonium acetate solution and 5 cc. of ammonium dichromate were added. For complete immediate precipitation a considerable excess of dichromate was advisable, and as much as 5 cc. apparently was not disadvantageous. Following the addition of dichromate the whole was boiled for less than a minute, and, after cooling, the filtration and titration were made as previously described.

In the determination made in this way, the starch solution added contained some lumps which did not break up on shaking. These retained the blue color until 25.10 cc. of thiosulphate had been added, which was what was required when no strontium was present. As the rest of the solution, however, was decolorized by a slightly smaller amount of thiosulphate, it was not quite certain that I might not have overshot by a few drops, and two students made the separation in the manner described. One found 25.33 cc., the other 24.96 cc., as the amount of thiosulphate required. The probability is that this degree of accuracy easily can be attained by most students; and that after two or three determinations had been made, the duplicates would agree within a few hundredths of a cubic centimetre.

In the separation of barium from strontium in barite, after fusion with sodium carbonate, leaching, and filtration, by which alkaline-earth carbonates are obtained on the filter, the process of dissolving the precipitate in hydrochloric acid, separating the strontium from the barium, and determining the latter, in no instance should take more than an hour. If the amount of strontium is known to be small, one precipitation only would be required, and the time could be correspondingly shortened. This method of separation would apply even if the barium chromate were ignited, but in a double filtration through the Gooch crucible and ignition of the precipitate there is danger of loss of asbestos, and the time and trouble required in weighing the crucible before and after filtration are to be considered. For a single determination this time would be less than that required for the standardization of the thiosulphate, but for a series of determinations the standardization can be made against a weighed quantity of barium chloride or nitrate without difficulty, and the time required for this operation is of little moment.

What is Radioactivity?

*Radioactive substances will affect a photographic plate and will ionize gases. This is due to the fact that radium and its salts give off three types of rays, called the alpha, beta, and gamma. The alpha rays travel with a velocity of about 20,000 km. per second and are positively charged. It was early found by Rutherford that their mass was comparable to that of a helium atom; and he definitely made the statement before the proof was actually obtained that the alpha particle was a helium atom with two positive charges on it. This was afterward proved by Sir William Ramsay and Professor Soddy, who dissolved some radium chloride in water and allowed the occluded gases to run into a spectrum-tube which had previously been evacuated. On allowing these gases to stand for a day or two, the spectrum of helium gradually appeared. The beta rays consist of negatively charged electrons, with a mass of about 1/1600th of a hydrogen atom. During radioactive changes, they are ejected with a velocity of from 100,000 to 186,000 miles per second. While the alpha particle is stopped by an ordinary sheet of note-paper, the beta particle will penetrate a thin piece of glass, but is completely stopped by lead one millimetre thick. All evidence points to the fact that the beta particle is similar in its properties to the electron found in a Crooks tube, and gives rise to cathode rays. The gamma rays are not material in character but are vibrations of very short wave-length in the ether. Just as the X-rays are formed in an X-ray tube by the stoppage of the cathode rays by impinging on the target, so the gamma rays are formed during radioactive changes when such changes give rise to beta rays; and these rays are expelled from the atom with the velocity of light. It is evident, therefore, that the gamma rays are practically identical with the X-rays, except that they are of shorter wave-length and penetrate matter to a much greater extent. Anything, therefore, is radioactive that gives out alpha, beta, or gamma rays, or all of them. All radioactive changes are accompanied by at least one of these rays. The elimination is due to the explosion of the radioactive atom, such explosion taking place at a definite rate, so that, in the case of radium itself, half is completely transformed in 1690 years. In the second 1690 years, half of what is left will have been changed. In the third period of 1690 years, half of what is left at the end of the second period will have been changed—and so on. The 1690-year period is called the half-life or half-value period of radium; and it can be readily seen that in 10 times the half-life period, only about 1% of the element will remain unchanged.

STEEL-WORKERS' WAGES have been raised 133% between January 1916 and October 1918, from $2.20 to $4.62 per 10-hour shift. In 1913 the U. S. Steel Corporation paid $2.85; now the average is about $6 per day.

*Richard B. Moore, Trans. A. I. M. E., Sept. 1918.

RENO, NEVADA

Manganese and Iron Deposits.—Tungsten Mills.—Technical Training.—Silver Revives Old Centres.—Recovering Gold and Quicksilver from Old Tailing.

Manganese deposits of Nevada are to be examined for the War Industries Board, and Walter S. Palmer, of the Mackay School of Mines at Reno, has been commissioned to report on all known deposits and on production. A large output has been made from a property near Las Vegas, in the southern end of the State, where extraction has been resumed lately after a brief suspension. Other deposits of considerable magnitude have been reported to exist near Coaldale, on the Tonopah & Goldfield railroad; near Cuprite, south of Goldfield; as well as in Elko, Humboldt, and Lyon counties. The vein near Coaldale is said to be over 20 ft. wide, forming the hanging wall of a deposit of manganiferous iron. The iron is of bessemer quality, containing little silica or phosphorus; and the lime capping, below which the ore is found, covers an area of great extent. Other large deposits of iron ore have been sampled and prospected lately, and attention is being directed to this metal for the first time, owing to expansion in iron and steel manufacture on the Pacific Coast.

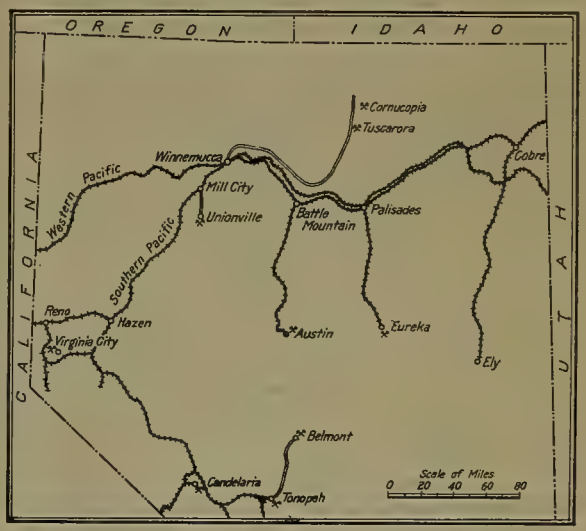
Two mills of 100 and 125 tons daily capacity, designed to dress tungsten ore, are nearing completion at Tungsten, near Mill City, in Humboldt county. A concentrating plant at Toulon, on the main line of the Southern Pacific, has been dressing ore from the same district, but hereafter will receive tungsten ore from the Winnemucca Lake district. The mills at Tungsten will concentrate ore from the mines of the Nevada Humboldt Tungsten Co., The Pacific Tungsten Co., and the Mill City Tungsten Co. Both mills were designed and constructed by K. Freitag of San Francisco. Water is obtained from the Nevada Valleys Power Co., which has laid a 6-in., wire-bound, redwood pipe-line over 4 miles long, with storage-reservoirs of 50,000 and 100,000 gal. capacity. Power has been supplied by a 34-mile transmission-line connecting with the Rochester line. Development of tungsten deposits has been resumed near Sodaville, in Mineral county, and two mills are proposed near this point.

Secondary mining schools are being conducted at Goldfield, Tonopah, and Ely, under the direction of Francis Church Lincoln, head of the Mackay School of Mines of the University of Nevada. Another school, similarly equipped, is traveling through the State, giving short courses in instruction at various mining centres. The courses are designed to fit men to become assayers, solution-men, cyanide or flotation-mill foremen, smelter foremen, machine-men, or assistants to geologists. The instructors are professors from the State mining school, and the classes have had a fair attendance. Mr. Lincoln reports a large demand for mine foremen, assayers, and other skilled workmen.

The high price of silver has resulted in reviving several of the famous old bonanza camps, notably Eureka, Austin, Candelaria, Belmont, Tuscarora, Unionville, and Cornucopia. Many isolated mines and prospects are again being worked. A. J. Stinson, State mine inspector, reports a greater number of mines in operation than at any time in recent years, although work is hampered by the shortage of labor and by the inefficiency of available labor.

The Candelaria Mines Co., headed by New York and Rhode Island men, has acquired the Badger, H. G., and Lucky Hill claims, and will erect a cyanide mill to treat the old dumps and stope-filling of the Argentum and Mount Diablo mines, paying the owners a royalty of 75c. per ton. It is said that sampling has indicated 1,000,000 tons of $14 ore. Development in the Lucky Hill has exposed high-grade ore, and in August, 8 men produced ore worth $14,000. The silver is a chloride, with a little gold.

Austin, in Lander county, is another of the old silver dis-



PRINCIPAL SILVER DISTRICTS OF NEVADA

tricts being revived. The Austin Dakota mine is being reopened to a depth of 200 ft., and is showing some high-grade ore, in addition to large bodies of good milling ore. Development has been in progress on other properties and a large tonnage of medium-grade ore has been blocked out.

Placer mining is recovering amalgam containing gold and silver from the bed of the Carson river, 6 miles below Empire, where bends in the river have caused to be deposited in the form of bars large quantities of tailing from the Santiago, Vivian, Merrimac, Brunswick, Morgan, and Mexican mills, which treated the product of the Comstock bonanzas. In the earlier period the ore had a greater gold than silver content, in the proportion of 60 gold to 40 silver. A tremendous quantity of quicksilver was used in the pan-amalgamation process, and all of this was finally lost in the tailing, while extraction of the metals was rarely above 65%. Sumps are dug in the sand of the river-bed, which contains many boulders precluding the use of dredges, and a 2-stage, 3-in., motor-driven centrifugal pump delivers the water and sand under pressure to another sump, where it is taken by a 4-in. Byron Jackson centrifugal pump, which raises the gravel 16 ft. to the sluice. The sluice is 65 ft.

long, lined with ordinary Hungarian riffles and cocoa-nut matting under expanded metal. Five feet from the end of the sluice, ⅛-mesh screens are used as a grizzley to carry the fine material to a side sluice, thus saving the concentrate on an under-current. Panning reveals some native quicksilver and quantities of carse lumps of amalgam. Tests appear to have proved the existence of quantities of valuable material in the river-bed, and production is said to be a question of mechanical methods. Tests have been made at the Mackay School of Mines at Reno, and the best results have been obtained in washing in sluices. Bedrock has not been reached, and a coarse concentrate recovered from the first tests assayed $15,166 gold and silver, and 20% mercury. Fine from this sample assayed $25,248 gold and silver, and 17% mercury; while third-grade fine assayed $1000 in precious metals. Amalgam recovered separately from the fine had a value of $1.05 per ounce. The operation, which is yet in the pioneer stage, is conducted by the Unevida Gold Mining Co., a Delaware corporation, of which A. B. Lewis of New York is president; W. S. McCornick of Salt Lake City, treasurer; and W. C. Ralston, Jr., secretary and manager. Some profitable hand-sluicing was done during the period of mill operation, but the present undertaking is the first to apply power to the recovery of metals from the river-bed.

Southern Nevada mining men are becoming interested in placer mining in Tule canyon, a branch of Death Valley, in southern Esmeralda county. Placer gold has been found at bedrock for a long distance along the dry bed of the valley in tributary gulches. Water can be made available by pumping from a few feet below the surface.

The scarcity of miners has materially curtailed the scope of work at Jarbidge and the Elkoro company's 300-ton mill is operating at less than half capacity.

LEAD, SOUTH DAKOTA

Accident-Record at Homestake.—Pyrite and Tin Mining.

Lead.—The Homestake company has established a new record in the elimination of accidents. For the first eight months of the present year no fatalities have occurred, while other casualties have been reduced greatly. In view of the fact that a large proportion of the mine labor consists of new men, the result is good. The safety of employees is looked after by an efficient organization, which deserves commendation.

Announcement is made by B. C. Yates, superintendent of the Homestake company, that women will be employed during the period of the War in the lighter surface occupations. This is made necessary by the shortage of labor and will relieve able-bodied men for mine work.

Rapid City.—The State School of Mines has received its second contingent of 124 men to be instructed in mining and telegraphy, also in military affairs. The course covers a period of two months. Barracks and a mess-hall have been erected, and good accommodation is given men that have been inducted into the service.

Deadwood.—Since commencing mining at his property, Olaf Seim has shipped 30 tons of pyrite daily, the total being over 500 tons. Only one eight-hour shift is employed. The orebody is large and carries 38% suplhur.

Hill City.—There has been considerable activity in this district within the past few months, and several tin properties have changed hands. E. C. Johnson of Chicago, who already owns the Gertie mine, has purchased additional ground and will start operations.

The American Tin & Tungsten Co. has completed unwatering the Cowboy mine, and is breaking ore for the mill. This is taken from the 200-ft. level, where the orebody has a length of 77 ft. and a width of 2½ ft. The shoot shows good ore in places. On the 300-ft. level the orebody has a greater length, and stoping will commence soon. A 60-hp. hoist is being erected at the Cowboy mine, and the one used heretofore will be set up at one of the company's other properties. A 20-cu. ft. skip will also replace buckets. The mill has been repaired, and arrangements are now being made to put in a mill to re-grind the jig and table middlings. In addition, an intermediate crusher in the preliminary crushing-plant will be erected, also a slime plant consisting of Deister plato slime tables, Cornish buddles, and rag-frames. The capacity of the mill will be 200 tons per day. It is the intention to make a mill-test of 2000 tons within the next few months and then shut-down for the winter. The development of the mines will be continued, and milling resumed early in the spring. Several hundred tons of ore have already been broken.

Placer mines in Lawrence and Pennington counties in 1917 yielded $924 in gold compared with $2111 in 1916.

VICTORIA, BRITISH COLUMBIA

Platinum and Mica.—Re-opening Mines in Merritt District. —Trail Smelter.

Mining and prospecting for platinum on the Tulameen river, is proceeding briskly, having been stimulated by interest of the Dominion Geological Survey. The Church company, of Tacoma, Washington, is doing a lot of work on the Tulameen above Bear creek. It has erected a big dam, and a flume 200 yd. long. Twenty men with three large centrifugal pumps are working the bed of the river over a distance of 700 ft., and are reported to be recovering considerable platinum and gold. Several smaller outfits are at work. The Government, having established camps at Slate creek, is sinking test holes to bedrock on the bars and benches to determine the value of the ground.

The Donohue Mines Corporation has re-opened its property at Stump lake, Merritt district. Engineers' reports state that the ground is traversed by a series of true fissure veins, all of which assay high in copper, gold, silver, and lead, with some zinc. New machinery and equipment are to be erected, and it is likely that a new concentrator will have to be provided. John D. Leedy, of Seattle, will be the new manager.

Mica deposits in the Cascades, discovered by W. Schmock, are being examined by F. W. Farrier, representing the Munition Resources Commission of Canada, and R. Graham, assistant professor of Mineralogy in McGill University. A feature of the ore receipts at the Consolidated smelter at Trail during the third week of September was 421 tons from the Mandy mine, Flin Flon district, Manitoba.

Fire threatened to destroy the entire plant of the Consolidated M. & S. Co. at Trail recently, but it was got under control with a loss of only $40,000. The Dwight-Lloyd sintering plant was destroyed. This structure was one of the oldest at the smelter, having been erected with hewn timbers 20 years ago. It was soaked with oil. The only explanation of the outbreak given is that the oil temporarily ceased to flow to the furnaces, then re-started without being noticed, resulting in its becoming ignited by the hot furnaces. Re-construction is being hastened. Six electric motors, one of 100 hp., two of 50 hp., the others in smaller sizes, were destroyed and will be the most difficult to replace. It is not thought that the lead plant will be shut-down, as there are old roasters that can be used.

There is every indication that the inquiry into the smelting charges and general policy of the Consolidated M. & S. Co. will commence at an early date. Messrs. Fowler, DeLashmut, and Anderson, three prominent mining men in this Province, who were nominated by the Associated Boards of Trade as being the proper persons to conduct such an investigation, have decided to accept their appointment at the hands of the Dominion government.

NEW YORK

Impressions of the Annual Chemical Exposition.

The fourth National Exposition of Chemical Industries was held at the Grand Central Palace, New York, during the week of September 23. This was probably the last time the building will be open for such a purpose until after the War, as the Government is to use it as a hospital.

With regard to the exhibits it will probably be generally conceded that both the managers of the exposition and the manufacturers and other exhibitors themselves succeeded in excelling last year's effort. All the available space was taken up, and attractions of interest and education seemed to be even in greater variety than in previous instances. This was due in part to the fact that the U. S. Railroad Administration would not agree to any expenditure for exhibits such as were shown by the various companies last year, indicating the resources of the country in those districts reached by the railroads concerned. It was felt in some quarters last year that exhibits of this kind were hardly suitable for such an exposition, although the good done in indicating a greater scope for industrial development was not questioned. The dominant purpose of this year's show seemed, however, less of an attempt to point out possible avenues of development of resources; and was, rather, a distinctly successful advertisement of the notable achievements of the country's chemists and manufacturers in entirely and successfully replacing foreign-made products with those of American manufacture. The loss of the railroad exhibits was, therefore, not noticeable as far as the general success of the exposition was concerned. Had much space been devoted to showing the resources of the country, in this way, a number of exhibits illustrating the present-day vitality of American progress would have, necessarily, been crowded out.

The successful development of the dyeing and ceramic industries naturally featured largely, and attracted a considerable amount of attention. Among exhibits of particular interest, on account of their novelty, was the booth under the direction of the Chemical War Service, where gas-masks and other interesting war appliances were on view; a panorama scene arranged by the Solvay Process Co., depicting a modern battlefield, with an exhibit of the company's products alongside and information as to their particular use in warfare; samples of ferro-chrome-zirconium and ferro-zirconium produced by the General Electric Co.'s equipment; a model sprinkler-system designed by the General Fire Extinguisher Co., in periodic operation; and many others. Striking though familiar exhibits included the enormous apparatus from the Buffalo Foundry & Machine Co.; an extensive display of products from the factories of the E. I. Du Pont de Nemours Co.; a number of new models of 'duriron' castings, and other makes of acid-resisting metal; excellent displays of metals and other products by the Anaconda Copper Mining Co., the American Metal Co., the Raritan Copper Works, the New Jersey Zinc Co., the Nichols Copper Co., and many others. A number of booths displayed varieties of precision instruments and recording apparatus of many kinds. Filtration equipment on view showed that little change in design or construction had been made in standard types during the year. A zenith revolving-drum filter formed part of a particularly neatly-arranged and well-designed model plant, and attracted considerable attention.

The addresses delivered during the week centred around the subject of the development of the chemical and metallurgical industries in the United States, particularly with reference to the war period since July 1914. The meetings were well attended, and much interest was displayed in the details of technical development portrayed by the speakers.

The fifth exposition is to be held at Chicago on September 22, 1919.

CHICAGO, ILLINOIS

Further Notes on the Bankers Convention.

The full resolution endorsing aid to the gold miners, passed by the convention of the American Bankers' Association on September 27, was abbreviated in the report sent by wire. Nevertheless, the essential features were preserved. The missing preambles were the following:

"Whereas this decline in production is due entirely to the fact that the cost of producing the gold-ounce as a commodity has exceeded the fixed price of $20.6718 per ounce, and

Whereas, the Secretary of the Treasury of the United States has stated that, next to food and ammunition, gold is the one most needed war-essential."

Aside from this, the resolutions, as printed in the 'Mining and Scientific Press' on October 5, were complete and correct. The importance of the position taken by the miners at the American Gold Conference at Reno was shown by addresses clearly stating that under no circumstances could the bankers endorse a program that involved any alteration in the standard gold-unit measure of value. One prominent delegate expressed the prevalent sentiment when he said: "If this resolution is intended for the purpose of providing an adequate wage to the gold-miner equal to every other miner, and if it is intended for the purpose of bringing returns on the capital invested in gold-mining enterprises equal to the return on other mining enterprises, then I favor it. If it is intended to provide a higher price for hoarded gold, whether coined or bullion, I oppose it (applause) for the reason that the National banks have been compelled to transport their gold-reserves to the Federal Reserve Bank, and the State banks have willingly handed over their gold-reserve, and we do not want any gold hoarder to make any money on a premium upon gold not now in public circulation." Eugene Davis, in his argument for support to the gold industry, said:

"The conditions that are so greatly intensifying the necessity of additional gold to strengthen and extend the foundation of our expanding credit-structure are causing an alarming decrease in gold production. The value of gold as a commodity having been fixed by law, its price remains stationary, while the cost of everything employed in its production has greatly advanced. The increased cost of labor is from 33% to 50%, with a decrease of from 40% to 60% in efficiency. Freight and smelter-charges have advanced fully 25%, while the cost of supplies has risen from 100% to 300%. The great deposits of gold-bearing ores are low in grade, and in normal times can at best be made to yield but a small profit by operating on a large scale and employing the most economical methods of treatment. For these mines to cease production means not merely a temporary loss of the normal output; in a majority of cases it means the permanent loss of the mines and of the gold locked up in them, for, once filled with water, allowed to cave and the equipment to deteriorate, the cost of re-opening would be so great as to be prohibitive."

Lively discussion ensued in regard to the attitude of the State banks, which had been severely criticized by Comptroller of the Treasury, John Skelton Williams. This brought a return-fine upon Mr. Williams at the convention, but the tempest was calmed by a rational resolution passed by the State Bank Section of the convention, advocating the shipment of all the gold-holdings of the State banks to the Federal Reserve banks, "where only it is of value in providing note-issues and in upholding the monetary and general financial structure of the country." Further resolutions indicated a tendency of the State banks to increase the number becoming member-banks in the Federal Reserve system.

ARIZONA

Clifton.—The Arizona Copper Co. has issued a statement showing results of the half-year ended March 31, 1918. The profit was £326,560 ($1,569,000), less taxes, etc., but plus revenue from other companies, making £257,098 ($1,234,000) net. From this was deducted interest on debentures, and reserve accounts, leaving £143,102 ($686,400). Dividends on preferred shares amounted to £12,266 ($58,000). On August 31, 1918, a dividend of 1s. 6d. (36 cents), amounting to £113,992 ($547,000) was paid on the ordinary shares. The balance on hand is £30,581 ($144,000). All the outstanding bonds were redeemed on March 25, leaving the company free of debenture debt. The output during the period was 7896 short tons of copper. The strike in 1917 affected operations, and although work was resumed in November, the normal output was not attained until March.

Globe.—The Superior & Boston Copper Co. has issued a report by Walter Osborn, mining engineer, and one by the superintendent, A. L. Graham. Mining operations in this property came under two main divisions; the first in the known orebodies above 800 ft., the second is exploration at depth to find sulphide ore. The Great Eastern, the principal lode, has been explored for a lateral distance of 2500 ft. It is mineralized for the whole length. In many places the copper is badly leached, only the iron remaining. Lenses of oxide ore occur, from a few inches to 20 ft. in width. The lode is badly faulted, but this trouble is understood. The lode is persistent and maintains a width of 30 to 40 ft. Careful exploration is necessary to find the good ore. A recent discovery is that of a body 100 ft. above the 800-ft. level, in the east end of the mine. It has been opened for 90 ft., and is 20 ft. wide, averaging 6% copper so far. This lens has important possibilities. The future of the mine lies in finding sulphides, so the 1200-ft. level is to be extended under the orebodies and under the leached portions of the lode in the east end.

Johnson.—The August output of the Johnson district approximated 5000 tons of 4% copper ore.——The Peabody Consolidated is preparing to resume development.——The output from the Dragoon Mountains Copper Co., for August, was 11 cars. New ore has been opened on the 400-ft. level. ——The McKay lessees on the Arizona United property are shipping 6 to 8 cars per month.

Miami.—Inspiration Consolidated pays $2 per share, $2,363,934, on October 28. This makes $6 for the current year.

Oatman.—The Oatman Bureau of Mines has sent a marked copy of the 'Oatman Mining News' to the 'Mining and Scientific Press'. The headline is: "Big strike in Arizona Mossback, puts Oatman on the map as world's greatest gold camp." This is followed by "W. H. Halcom, of the directorate, withholds announcement until all elements of doubt had been eliminated. $25,500,000 worth of $25 ore in sight with stupendous reserve body that will keep 300 ton mill busy for years. Value up to $10,000 a ton with plenty of $500 and $700 ore for anyone to see and examine. No stock for sale, so there's nothing to exploit but the truth." The Oatman Bureau of Mines, wishing to correct this, noted that 'Halcom' should be 'Holcomb'; the word 'had' should be 'have', and '$25,500,000' dwindles to '$2,500,000'. Exaggerations from Oatman have been commented upon editorially in this journal during the boom there, and more of it will do Oatman no good. The Arizona Mossback Mines Co. is sinking to 500 ft., the shaft being 435 ft. deep at present. This mine has been worked for 17 years, during which time 1700 ft. of work was done to the 300-ft. level. The present owners unwatered the workings during July of 1918, and started sinking in August. It is now estimated that reserves are 100,000 tons of $25 ore. The 'pay' orebody so far is said to be 18 ft. wide on the 50-ft. level, 25 ft. on 120 ft., 45 ft. on 200 ft., and 67 ft. on 300 ft. On the dump is 3000 tons, in which free gold is reported as visible. A 200 or 300-ton mill is being designed, to be in operation by mid-1919. C. W. Maier is president and general manager and J. Lamb superintendent.

Superior.—The Grand Pacific Copper Co. will ship 300 tons of copper ore during September, compared with 150 tons in August. The ore-shoot that was opened on the first and second levels has been developed 175 ft. below the second, exposing commercial ore. The copper ore occurs in a cross vein cutting the bedding rocks at right angles, conditions closely paralleling those of the Magma mine.

CALIFORNIA

Blythe.—There is reported to be some activity near this place in Riverside county. W. A. Hanson and W. Villman have a property from which, according to the Riverside 'Enterprise', assays return high content in nearly all the metals.

French Gulch.—A hoist, costing the Gladstone mine $13,000 five years ago, and used for three years, has been sold and shipped to the Tintic Standard Mining Co. at Eureka, Utah. The purchaser paid exactly what the hoist cost originally, also $2000 for removing it from the mine, where it was at the inner end of a 3600-ft. tunnel. The purchaser must also pay the freight to Utah. The hoist and its accessories weigh 50 tons.

San Jose.—The so-called 'meteor' in Alum Rock park, 6 miles from this place, has been sampled by the city authorities and found to assay 53% manganese. It is thought that there is between six hundred and several thousand tons of ore available. The city manager, E. Bailey, has been in touch with L. H. Duschak of the U. S. Bureau of Mines and G. D. Louderback of the University of California regarding disposal of the ore.

Winthrop.—The flotation plant at the Bully Hill mine will be started about the end of October. Additional housing accommodations must be provided for the extra men who will then be employed. The Bully Hill mines are now employing 90 men. Ore shipments are made regularly to the smelter at Kennett.

IDAHO

Cascade.—Quicksilver and antimony deposits in central Idaho have been examined recently by the State Inspector of Mines, R. N. Bell. The mercury deposits are situated along the eastern border of the Yellow Pine district, formerly in Idaho but now in Valley county. This part of the

district is entirely embraced within the drainage-area of the east fork of the south fork of Salmon river, and is approached from Cascade on the Oregon Short Line over the old Thunder Mountain road that was built by State and private capital during the Thunder Mountain boom of 15 years ago. The distance from Cascade to the Fern mine, which is the centre of the present activity, is a little over 70 miles. Of this distance, the first 30 miles to Knox, and in fact to Cabin Creek summit, 6 miles beyond Knox, is within the Payette national forest, and has received some support from that Government department in maintenance of the wagon-road which is now barely passable for auto travel, as far as Knox. From that point it is 40 miles to the quicksilver district, over the most atrocious excuse for a wagon-road in the State. Freighters refuse to contract delivery, but work by the day, charging $8 or $10, according to the quality of the team, with food furnished for man and horses and a demand of 8 or 10 days for the round trip, which, with the present high cost of horse-feed, brings the cost of delivered freight to the district to approximately $100 per ton. The elevation of the road is from 4700 ft. at Cascade to 9000 ft. near the Fern mine. The region is well watered and timbered. Mr. Bell discusses the geologic features as exposed. The Fern company has done a fair amount of work. Three or four men are extracting ore from the surface and a tunnel. The furnace is of the old Johnson-McKay type, consisting of 12 cylinders 12 in. diameter and 6 ft. long, fitted with condensing apparatus. Each holds 150 lb. of ore. The furnace is fired with wood. C. H. Richmond of California is in charge of this plant, which has a daily capacity of 3 tons of ore, carrying 5% mercury. The Yellow Pine company's claims adjoin those of the Fern. Other operators are the Idaho Quicksilver Mines, and Chief, controlled by Boise people. One of the most promising cinnabar claims is that of Pringle Smith, situated north of the Gold King mine on Thunder mountain. This was the first discovery of mercury in the district, 15 years ago. The Hennessy property, a mile south-west of the Smith, is considered worth watching. Near this cinnabar is some promising antimony deposits. Twenty miles north-west of the Fern quicksilver mine is the Yellow Pine antimony mine. Here a 25-ton plant is being erected by the Frank Nowak Co. of Chicago. The American Continuous Retort Co. of Denver is supplying the equipment.

Kellogg.—Grant Smith & Co. of Portland, Oregon, has been awarded the contract for completing the Pine Creek branch of the O.-W. R. & N. Co. Some of the grading has been done. Four or five miles can be laid before snow falls. This line will enable the Constitution, Douglas, Highland-Surprise, Nabob, and other mines to ship ore.

Mullan.—John A. Percival has opened a tungsten deposit 150 ft. across, said to average 15% WO_3, but large samples assayed much higher. This property lies a few miles north of the Consolidated Interstate-Callahan mine, of which Mr. Percival is president.

KANSAS

Cherryvale.—The Edgar Zinc Co. has started operating its smelter here at full capacity again, having been at half capacity during the summer. The plant has 4800 retorts.

MISSOURI

Joplin.—Production of the Tri-State region last week totaled 9663 tons of blende, 534 tons of calamine, and 1432 tons of lead. These averaged $58, $40, and $100 per ton, respectively. The total value was $708,660, of which Missouri contributed $131,498.

MONTANA

Butte.—The 'Miner' of September 29 says that the I. W. W. agreed to resume work in the mines and the strike that was called on the 12th is ended. This action was taken on the 28th at a closed meeting of Metal Mine Workers' Union, local No. 800 of the I. W. W., when members of that body agreed to return to the mines, pending Federal adjustment of their grievances. At the conclusion of the meeting, Federal agents asserted that they had unveiled a plot said to have been hatched by I. W. W. leaders, which, the officers said, would result in a riot.

It was alleged by Government men that the men were urged to besiege the Federal employment bureau and demand Government rustling-cards. The Federal mediator, Tom Barker, explained that the Government rustling-card has not been accepted by organized labor and has not been adopted at the Butte mines. He declared that leaders who had urged I. W. W. to demand rustling-cards from the employment bureau had deliberately and maliciously attempted to fan the fires of discontent. Federal agents are adopting measures calculated to suppress any trouble and promptly quell any disturbances Monday mroning, for it is feared that many illiterate members of the I. W. W. have accepted these alleged statements relative to a purported employment card for the one now used by the mining companies, of the leaders as the truth. Although the mining operators of the Butte district have offered to adopt the Government rustling-card, the American Federation of Labor must be consulted before this form of employment card is accepted. In his report to Washington officials Mr. Barker has requested that the local situation be given the earliest possible consideration. B. K. Wheeler, United States district attorney, addressed a letter of rebuke to D. M. Kelly, counsel for the Anaconda Copper Mining Co., who is alleged to have said that the local Federal authorities have failed to enforce certain laws and thus have made Butte a haven of refuge for the members of the I. W. W. organization and for persons classed by him as the radical element.

The Tuolumne company is to absorb the Colusa-Leonard company on the basis of one share of the former for four of the latter. For some time the Tuolumne has been in control of the Colusa. The output in August was 2700 tons, but at present daily shipments are 100 tons. The 800-ft. level is opening well.

The Butte East Slope company is preparing to resume operations. The ore in the oxidized zone carries gold and copper. E. P. Lomas is manager.

Hassel.—The Iron Mask mine in Broadwater county, has been developed to 375 ft. It formerly yielded manganese-iron ore. A rich streak of steel galena has been found a few inches from an old drift. The shoot is 120 ft. long and of unknown height.

Helena.—Drifts on the 400-ft. level of the Helena mine have disclosed 2 ft. of galena, valued at over $30 per ton. The mine is owned and operated by the Cruse Developing Company.

Rimine.—After opening old workings of the Lee Mountain mine and shipping 37 cars of ore to smelter, this mine is closed. There is plenty of ore available.

Saltese.—The St. Lawrence Copper Mining Co.'s property was recently visited by Eastern shareholders. Considerable development is under way, in charge of H. M. Lancaster. A new road has been constructed to enable traffic to continue through the winter.

NEVADA

Carson.—On October 15, Raymond T. Baker will confer with Western assayers to discuss the precious-metal industry.

Goldfield.—The Reorganized Blue Bull Mining Co. has issued a statement covering the year ended August 31, 1918. On the 700-ft. level of the Hat shaft a total of 1800 ft. of openings have been made, including work in the Victor claim of the C. O. D. company. On the veins found

800 ft. was driven. As the ore was not in commercial quantity, work was stopped. The Simmerone shaft was then prepared for exploration in the north end of the property. On the 100-ft. level, a vein 6 to 18 in. wide, assaying from $100 to $800 per ton, was opened. From a winze, 21 tons of $117.29 ore was sent to the smelter. By raising from the 250-ft. level, and connecting with the winze, the ore-shoot was found to be 50 ft. long, 6 to 18 in. wide, worth $100 per ton in gold, silver, and copper. Expenses were $1000 monthly during the past 16 months. Assessment No. 7, of 1c. per share, has been levied.

Tonopah.—The West End Consolidated pays 10c. per share on October 16. This is equal to $178,849, and makes $357,698 for the current year.

The Tonopah Mining Co. pays 15c. per share, equal to $150,000, on October 21.

Virginia City.—The Mexican Gold & Silver company has levied an assessment of 10c. per share, due October 23. This will realize $20,160.

NEW MEXICO

Steeplerock.—After a suspension of operations, the Carlisle mine and mill have been re-started. A New York syndicate had an option on the property, but gave it up.

OKLAHOMA

Picher.—Production of the districts last week totaled 7493 tons of blende and 1177 tons of lead, valued at $543,322.

Miami.—The ore-warehouse project is said to be worrying smelter-men, who think that they may have to buy concentrate in the open market and so pay a higher price. The warehouse at Picher will be finished in 30 days, while one at Douthat has been started. The Oklahoma Mining Exchange is the 'father' of this scheme. The Oklahoma Ore Producers' Association, of Picher, favors the idea and is advising mine-owners to send their products to the warehouses.

OREGON

Baker.—S. L. Shonts, of Wallace, Idaho, has recently returned from an investigation of the chrome deposits of eastern Oregon—Grant, Baker, and Willowa counties. The chief producers are in Grant, centring around Canyon City, Prairie City, and John Day, old gold placer districts. Most of the mines are 10 to 20 miles from rail; a few are 40 miles. Freight to the East is $16 per ton. It is estimated that these counties have yielded 11,000 tons in 9 months, and should total 18,000 tons for the year.

Grants Pass.—The Oregon Chrome Mine, in charge of H. Sordy, reports that the road from the property to Waters Creek is complete. Auto-trucks are ready to haul chrome to rail. Supplies were formerly packed in by way of Galice, but that route is now to be discontinued in favor of the easier and quicker road from Grants Pass.

SOUTH DAKOTA

Deadwood.—A contract has been let by W. E. Elder and others for the driving of a 1200-ft. tunnel in the Carbonate district. It is claimed that there are rich silver lodes in the ground to be opened.

UTAH

American Fork.—Development in this region is hampered by lack of labor. The Bay State and Miller Hill mines have been closed.

Eureka.—The Eureka Bullion mine has been examined by J. H. Weber. The shaft is 825 ft. deep. At 138 ft. the vein was found, being 12 ft. wide, assaying 28% iron, some gold, silver, lead, manganese, and calcite. The vein shows the pay-ore has been leached deeper, but it proves the larger north and south vein which makes the big orebodies.

Lark.—The Ohio Copper Co.'s mill, which was considerably damaged by fire during August, was expected to start again early in October.

Park City.—This district produced 8285 tons of ore and concentrate during September. The list of shippers is as under:

Mine	Tons
Judge	2863
Ontario	2080
Silver King Coalition	1503
Daly West	720
Daly Mining	541
Naildriver	45
Creek jiggers	33
Miscellaneous	500

Daly West is to increase its capital from 180,000 to 250,000 shares. The par value is $20. A connection between the new cross-cut and shaft is expected at an early date. Lessees mined 184 tons of $55.64 ore in August.

The Daly Mining Company pays 10 cents per share, equal to $15,000, on October 1. This makes a total of $3,030,000. The weekly output is from 80 to 200 tons of ore.

Tintic.—Ore production of companies and lessees during September totaled 30,000 tons, a little better than in August and July. Dragon Consolidated headed the list with 7500 tons, followed by Chief Consolidated with 5500 tons, Iron Blossom with 2500 tons, Tintic Standard with 2500 tons, and Centennial Eureka with 2400 tons.

Silver production of Chief Consolidated was 1,328,968 oz. for the first half of 1918, nearly as much as for all 1917.

WASHINGTON

Northport.—The Electric Point lead mine near here has finished erecting its aerial tram, and probably will increase its daily output from 40 to 100 tons.

Silver Hill.—A promising tin property is being developed here, 11 miles from Spokane. The property is owned by John A. Percival, president of the Consolidated Interstate-Callahan Mining Co. of Idaho.

CANADA

British Columbia

Atlin.—Near this place is an immense deposit of magnesite, which has been examined in the past by Canadian geologists. So far it has not been exploited, because of the distance from points of consumption. The ore would have to be hauled a long way and trans-shipped several times.

The Gold Commissioner for this district reports that on Pine creek the Columbian Mines Co. operated with 40 men last year, in charge of P. W. Greyer. Work has since been stopped on account of judgments against the concern. It is said that at a sheriff's sale, 52 claims and an immense quantity of equipment were sold for $62. Wages are owing to miners, and the whole affair is considerably mixed.

Britannia.—The Howe Sound Co. pays 5c. per share on October 15. This amounts to $99,207.

Fernie.—On September 21 there were 1200 coal miners out on strike in this district. They demanded the introduction of the single-shift system in the Crow's Nest Pass collieries on account of certain dangers. If the 9000 men employed walk-out, it will be serious for the metal-mining industry.

Hedley.—The Hedley Gold Mining Co. paid a dividend of 15c. per share on September 30.

Rossland.—The Granby Consolidated is preparing to extract ore from its Velvet copper-gold mine. Fifty men are employed.

The chrome belt west of Rossland is said to show good indications.

Slocan.—The Rambler-Cariboo Mining Co. had a surplus of $29,120 on August 3, plus ore in transit valued at $21,000. Present profits are $2000 monthly. The mill is working one shift on account of lack of men. W. A. Cameron is superintendent.

Ontario

Boston Creek.—The new railroad station here is complete. Telegraphic service is also available.

Cobalt.—Nipissing Mines Co. pays a dividend of 10% on October 21.

The Edwards-Wright company, operating the Green-Meehan mine, in which high-grade ore was opened at 240 ft., has decided to sink deeper.

At the Genesee water has retarded operations, and more pumps are being installed.

The McKinley-Darragh has cut high-grade ore in its Savage mine.

The Beaver is taking out high-grade ore from the 300 and 400-ft. levels, and has discovered ore 28 ft. wide in the diabase on the 500-ft. level.

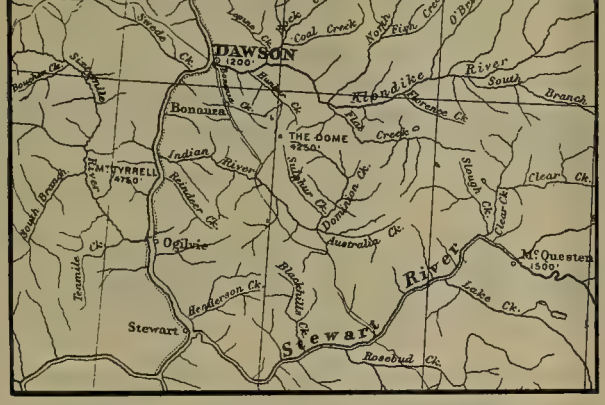
La Rose has opened a rich vein in the Violet property at a depth of 410 feet.

Kirkland Lake.—The 150-ton mill for the Wright-Hargreaves company is to be designed by James Grant of the McIntyre-Porcupine company.

Lake Shore yielded $44,000 from 1732 tons during August. Since the mill started in March it has treated 9393 tons worth $236,049.

Yukon

Dawson.—Alfred Thompson, member for the Yukon, who is at Ottawa, stated that it is his intention to ask Parliament at its next session as a war measure, to remove the royalty on gold produced in the Yukon. This can be done by passing the necessary amendments to the Yukon Placer Mining Act. He considers that his proposal would be in the best interests of the Allies in view of the desirability of increasing gold production, and the suggestion which has been made in some quarters that a bonus should be given to encourage gold mining.



PRINCIPAL PRODUCTIVE AREA OF THE KLONDIKE

The Yukon Gold Co., operating dredges at Dawson, in Alaska, Idaho, and California, and a mine in Nevada, has suspended dividend payments. The estimate of income for 1918 is a disappointment, due to causes affecting all gold producers. Owing to shortage of power in California, the company's operations have been curtailed.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

John P Gray, of Idaho, is here.

Horace V. Winchell was in San Francisco this week.

Marion L. Thomas has returned to New York from Cuba.

E. A. Julian, manager for the Goldfield Consolidated, is at Reno.

J. C. Martin has returned from Valdez, Alaska, to San Francisco.

John W. Mercier sailed from New York to Europe on September 25.

C. V. Hoskins, manager of the Jerome Verde mine, is here from Arizona.

Carl Trischka is at the Engineer Officers Training School at Camp Humphreys, Virginia.

C. A. Filteau has been appointed manager of the Peterson Lake mine at Cobalt, Ontario.

Duncan MacVichie of Salt Lake City has returned to his home from a visit to Yerington, Nevada.

L. S. Cates, manager of the Ray mine, is serving on the Draft Appeal Board at Phoenix, Arizona.

Norman Carmichael is serving as chairman of the United War Work Campaign at Phoenix, Arizona.

E. R. Abadie, Jr., has been appointed superintendent of the Golden Center mine at Grass Valley, California.

B. R. Brown has been made superintendent of the La Grange mine, to succeed **Louis Webb**, who has resigned.

T. E. Mitchell, until recently general manager for the Burma Mines, Ltd., is here on his way from Burma to London.

Stanley C. Sears has received his commission as Captain of Engineers, U. S. Army, and is stationed at Camp Humphreys, Virginia.

W. J. Loring, engineer representing Bewick, Moreing & Co. of London, has been at Mill City, Nevada, supervising the construction of a tungsten mill.

J. K. Turner, engineer in charge of several Goldfield properties, is at Reno attending a session of the Federal District Draft Board, of which he is a member.

Dwight Garrison, Lieutenant in the Coast Artillery and the son of F. L. Garrison, of Philadelphia, is now stationed at Fort Winfield Scott, near San Francisco.

George E. Bowen, of Leadville, Colorado, has obtained a commission as First Lieutenant, Engineer Officers Reserve Corps, and is now at Camp Humphreys, Virginia.

Frank Wilson, formerly connected with the Syndicate Mining Co., Masbate, P. I., has accepted a position with the Mexican Candelaria Co., S. A., of Sinaloa, Mexico.

W. A. Bradley, manager for the Pittsburgh Silver Peak Gold Mining Co., has been at Tonopah. His company has abandoned the Rawhide mine on the Mother Lode.

C. D. Kaeding, manager for the Dome Mines, of Porcupine, has been in the Mason Valley district, Nevada, and was among the first to be taken in the new draft at Reno.

James F. Kemp, Waldemar Lindgren, A. C. Lawson, Walter Wiley, and **Reno Sales** are at Bingham, preparing evidence for the three apex cases that are impending.

E. C. Hickman, metallurgist for the A. S. & R. Co. at Murray, Utah, has resigned to accept a position as assistant superintendent for the St. Joseph Lead Co. at Herculaneum, Missouri.

J. W. Moffet, many years manager of the Beaver Consolidated at Cobalt, Ontario, has resigned owing to ill health. He is succeeded by **L. W. Ledyard**, recently manager of the Teck-Hughes at Kirkland Lake.

THE METAL MARKET

METAL PRICES

San Francisco, October 8

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound	12
Zinc-dust, cents per pound	15

ORE PRICES

October 8

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, 38 to 48%, California, per unit	$1.25—$1.50
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Magnesite, crude, California, per ton (nominal price)	$7.00—8.00
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 85% MoS_2	$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$25

EASTERN METAL MARKET

(By wire from New York)

October 8.—Copper and lead are unchanged. Spelter is dull and lower.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

Date	New York,	London,	Average week ending	
Oct. 2	101.12	48.81	Aug. 27	101.12
" 3	101.12	48.81	Sept. 3	101.12
" 4	101.12	48.81	" 10	101.12
" 5	101.12	48.81	" 17	101.12
" 6 Sunday			" 24	101.12
" 7	101.12	48.81	Oct. 1	101.12
" 8	101.12	48.81	" 8	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date		Average week ending	
Oct. 2	26.00	Aug. 27	26.00
" 3	26.00	Sept. 3	26.00
" 4	26.00	" 10	26.00
" 5	26.00	" 17	26.00
" 6 Sunday		" 24	26.00
" 7	26.00	Oct. 1	26.00
" 8	26.00	Oct. 8	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.18	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

The price-fixing committee of the War Industries Board and producers are to confer on copper prices from October 15 to 20.

Owing to shortage of labor, refineries are said to be behind production.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Oct. 2	9.50	Aug. 27	9.16
" 3	9.40	Sept. 3	9.42
" 4	9.35	" 10	9.41
" 5	9.25	" 17	9.62
" 6 Sunday		" 24	9.76
" 7	9.20	Oct. 1	9.55
" 8	9.15	" 8	9.31

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
Oct. 2	8.05	Aug. 27	8.05
" 3	8.05	Sept. 3	8.05
" 4	8.05	" 10	8.05
" 5	8.05	" 17	8.05
" 6 Sunday		" 24	8.05
" 7	8.05	Oct. 1	8.05
" 8	8.05	" 8	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.28	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
Sept. 10	120.00	Sept. 24	120.00
" 17	120.00	Oct. 1	120.00
		" 8	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

Tin imports into the United States in seven months of 1918 totaled 53,027 tons. This is at the rate of 81,163 tons per annum, closely tallying with the 80,000 tons to be allocated this country, as determined by the Inter-Allied Tin Conference at London. Of the tin imports, 17% come in as concentrate, against 13% for the whole of the last fiscal year.

Ferro-manganese: The Sub-Committee on Ferro-alloys has sent notices to importers of the British alloy that any further imports will probably be impossible, as it is felt that British blast-furnaces can better devote any excess capacity to making pig-iron, which is scarce both in Great Britain and the United States, and also because the United States can supply its own needs in ferro-manganese as well as those of Canada. This means that this country will probably export to Canada instead of the alloy coming from Great Britain. The quotation is unchanged at $2.50 per unit for 70% alloy, with $3.50 per unit added and subtracted above and below the standard. Probably this could be shaded on a good inquiry.

Eastern Metal Market

New York, October 2.

The markets are all quiet and transactions in those where an open market prevails have been small. There have been no startling developments, but in view of the war situation some may spring up any day.

Copper production presents a somewhat more encouraging aspect, but the effect on the market produced by the new draft on the labor situation is watched with interest.

Tin business has almost come to a stop, but prices are a little stiffer.

Lead supplies continue meager, with the control of all avenues of the trade very tight.

Zinc is inactive and the trading of the market has been softer each day.

Antimony is a little stronger.

The most interesting announcement in the steel industry is that of the United States Steel Corporation which last week stated in a special bulletin that after October 1 the basic 8-hour day would be effective in computing all wages of employees. This amounts to another increase in wages, since men working 12 hours continuously will receive six hours' pay for four hours of overtime, which means a 16⅔% advance. It is expected that independent steel-makers will follow in the new departure. An advance in freight rates, amounting to nearly 10%, will become effective by November 1, applying to New England and generally to points east of Pittsburgh. Steel production in September has exceeded that for August, with two days less for working.

COPPER

How the draft will affect the labor situation is an absorbing topic. It is likely that miners of copper and workers in refineries will be accorded special consideration, as the labor supply, particularly of the right sort, is by no means ample, and copper is a decided war necessity. The refinery situation as to labor is expected to be better as the cooler weather comes on. The output of crude copper seems to have been better in August than in July and also than in August a year ago. The output of 16 domestic and 4 foreign prominent mines in August is put at 151,790,000 lb., as against 151,359,000 lb. in July. The total for the eight months ended August 31, 1918, is estimated at 1,230,042,896 lb., or about 50,000,000 lb. in excess of that for the same eight months a year ago. The price question is looming up. The present 26c. price holds until November 1, and the new one, if any change is made, will probably be decided by October 15. That is the expectation which is quite general now. July imports of copper are placed at 16,500 tons, making the total for the seven months 130,000 tons, as compared with 144,000 tons to August 1, 1917. Casting copper, as well as jobbing lots of refined copper, are said to be selling under the fixed maximum of 27.35c. per lb. This is regarded by some as significant, pointing to a greatly lessened domestic demand for ordinary non-war purposes. The demand for raw copper, as well as for brass from Europe, is heavy.

TIN

Again there is nothing official or otherwise to report regarding the international situation. The proposition to control the distribution and price of tin by means of an International Executive Tin Committee, sitting in London, is understood to have been settled, and announcements to this effect have come from Washington, but details as to the working-plans are still unknown. It is said that the Dutch and Chinese have not fallen in line and are still maintaining high quotations. Neither is anything known yet as to the fate of American importers. They are still on the anxious-seat as to their future life-work, but continue to report on the job each day. About the actual market there is little to say this week. There have been sales of small lots of all the grades of tin available for nearby delivery; but it is in the market for future delivery where the big business is usually done; this market, however, has been dead. Consumers are still refraining from entering the market. For November shipment from the Straits probably 71.25c. per lb. could be done. The spot and early-delivery market is again higher at 82c. per lb., New York, nominal, but the quantity available is very small. Arrivals at Pacific ports to September 25 have been 3620 tons and at Atlantic ports 1025 tons to September 30. The London market continues to fall, with spot Straits quoted yesterday at £337 10s. per ton, against £340 10s. a week ago.

LEAD

The lead market has settled to one of routine. All the metal available, every ton and even every pound, is under the strict control of the Lead Producers' Committee as to distribution and price, the latter being fixed by agreement at 7.75c. per lb., St. Louis, or 8.05c., New York. Everywhere one hears nothing but commendation for the manner in which this committee is handling such a difficult situation, which was made especially hard by the scarcity of the metal. There is at present no relief in sight on this score. Imports of lead, as well as exports, have been larger this year than last. The total imports to August 1, 1918, have been 52,473 gross tons, against 34,482 tons in the same seven months last year.

ZINC

The market continues easy, with the demand exceedingly light for domestic consumption, but there are rumors that fairly large inquiries for foreign account are shortly to appear. Consumers do not seem interested, nor do sellers appear anxious. The market has gradually declined, each day nearly, in the week, until yesterday prime Western for October or early delivery was quoted at 9.05c., St. Louis, or 9.40c., New York. Spot delivery was generally held at 9.15c., St. Louis, or 9.50c., New York. For November-December shipment the quotation was fairly firm at 8.90c., St. Louis, or 9.30c., New York. For grade A zinc 12c. per lb. base is still the Government maximum price. According to the Government's weekly report of output and stocks of zinc, the former had increased about 600 tons in the week, and the latter has decreased about 700 tons.

ANTIMONY

The tone of the market is stronger and the quotation for wholesale lots for early delivery is 14c., duty paid, New York. There has been some bidding among dealers.

ALUMINUM

Government maximum prices control the market for No. 1 virgin metal, 98 to 99% pure and for scrap at 33c. per lb. for 50-ton lots, at 33.10c. per lb. for 15 to 50-ton lots, and at 33.20c. per lb. for 1 to 15-ton lots.

ORES

Antimony: No developments again in this metal.

Molybdenum: Prices are nominal at $1.25 to $1.50 per lb. of MoS_2 in 90% material. Government orders are a possibility.

Company Reports

GOLDEN HORSE-SHOE ESTATES CO., LTD.

Property: mine and mills at Kalgoorlie, Western Australia, one of the most important in Australia.

Operating Official: J. W. Sutherland, general manager.

Financial Statement: bullion and sundries in 1917 realized £413,581 ($1,990,000). The profit was £100,797 ($487,000).

Dividends: two, No. 41 and 42, amounted to £82,500 ($398,000), making £3,375,000 ($16,200,000) to date.

Development: there was 6310 ft. of new work done, making 163,996 ft. to date. Last year 3862 ft. was in ore. The main shaft is 3252 ft. deep, and No. 2, 2513 ft. deep. No. 4 lode at 3140 ft. is showing good ore. Reserves total 748,352 tons, assaying $9.58 per ton, an increase of 40,000 tons. Three lodes contain all save 7055 tons of this.

Production: an average of 90 stamps crushed 176,028 tons of 51s.8d. ($12.40) ore. The sand, slime, and concentrate plants treated 49,488, 109,844, and 16,696 tons, respectively, extracting 89.4% of the total gold. Fine gold sold was 95,660 oz. Since 1899, 3,876,043 tons have yielded 2,509,586 ounces.

Costs:

Mining	$3.08
Milling (crushing, stamping, classifying, concentrating, and fine grinding	1.53
Total at mine, excluding development	6.84
Sand treatment (percolation)	0.92
Slime treatment (settling, agitating, filter-pressing, etc.)	1.84
Concentrate treatment (roasting, grinding, filter-pressing, etc.)	3.50

CHILE COPPER CO.

Chile Exploration Co.

Property: extensive property and works at Chuquicamata, Chile.

Operating Officials: H. C. Bellinger, general manager; B. T. Colley, manager of welfare department. Consulting engineers, Fred Hellmann, mining; E. A. Cappelen Smith, metallurgical; H. A. Guess, milling; P. H. Thomas, electrical; Fred Sargent, power; and S. B. Williamson, construction engineer.

Financial Statement: results in 1917 may be tabulated as under:

Sales of copper	$18,908,855
Operating charges	11,751,778
Interest and taxes	2,365,758
Plant, ore depletion, discount, etc.	2,842,202
Surplus, including $649,294 miscellaneous income	2,598,411
Balance from 1916	1,790,218
Total surplus	4,388,629
Less adjustments, depletion, plant	3,786,511
Net surplus to 1918	602,118
Current assets, including cash, metal, supplies, investments	21,654,877
Current liabilities, including depletion reserve and surplus, less unamortized discount on bonds	8,392,853

Development: prospect drilling amounted to 1842 ft., against 9519 ft. in 1916. Two holes were put down 737 and 1165 ft., respectively, to determine the southern limits of the orebody. There was no ore at this point. Further prospecting has been suspended. Total drilling is 60,786 ft. Reserves of positive and probable ore amount to 700,000,000 tons, averaging 2.12% copper.

Production: the past two years compare as follows:

Year	Tons leached	Per day, tons	Copper, %	Recovery, %	Copper, lb.
1917	2,904,191	8067	1.757	81.80	88,370,000
1916	1,739,812	4887	1.720	77.70	42,688,000
1915*	625,394	....	1.710	66.87	10,944,000

*7½ months.

Plant: eight electric and steam-shovels are now in operation, also eight locomotives, and two electric churn-drills. Alterations were made to the primary and secondary crushing plants—seven disc-crushers replacing eight rolls at the latter. Five more discs are to be added. Car haulage of tailing has proved better than belt-conveyors, and the disposal system now handles 1000 tons per hour. The sulphuric-acid plant was always able to meet requirements of the leaching department. At the smelter a second wire-bar furnace was completed. The whole plant is to be enlarged to a capacity of 15,000 tons daily, instead of 27,000 as contemplated. This is for the time being. There was no trouble in securing ample labor. The natives are rapidly adapting themselves to important operations. The number of people living on the property total 9287. The welfare department did much toward the contentment of employees.

Penarroya Mining & Metallurgical Co.

This famous lead-silver producer is one of the leading mines of Spain. The properties are situated in the southern part of the country, the metal mines being near Granada. The company is controlled by French shareholders. The size of the operations is shown by the fact that in 1917 the company marketed 7,715,354 fine ounces of silver, 330,708,400 lb. of refined lead, and 3,740,600 lb. of spelter. This production represents a diminution from the returns for the previous year, ascribed to a decrease in the tenor of the ores from the mines in the district of Linares. The corporation also owns and operates coal mines in Spain that produced last year a total of 756,000 tons. These mines are in the Peñarroya basin, near which is the principal smelter. Owing to the shortage of coal in Spain, however, the company has been obliged to deliver a large part of the output from its collieries to the Government for use on the railways, while it brought coal for its own operations from England. The total production of coal from the mines of Spain was 5,972,000 metric tons (1 metric ton = 1.102311 avoirdupois ton) during the year 1917, and is rapidly increasing under the impetus of favorable legislation. The Peñarroya company, being the owner of a fleet for its own operations, was in a position to secure coal from abroad, especially since part of its shipments of metal were made to England, or delivered to France for the benefit of the Allied cause. The total galena recovered from the ores of the company amounted to 70,072 metric tons, and of zinc blende 2940 metric tons. From outside sources there was delivered to the Peñarroya smelters 3080 metric tons of galena and 3263 metric tons of zinc blende. On account of the shortage of labor and the increase of wages to more than double the rates prevailing before the War, the company is preparing plans for a complete reconstruction of its Peñarroya smelter, following the most-advanced American models. To this end, the manager has recently visited the United States to study our large plants and methods, and to arrange for the delivery of at least a part of the equipment needed by manufacturers in this country. One of the objects is to reduce the amount of hand-labor required, substituting mechanical appliances as far as possible. The company has also put in blast a new smelter at Marseilles, France, treating ores from Spain and from mines belonging to the same concern in Pierrefitte in the Pyrenees. In addition to these enterprises the Peñarroya company has undertaken large mining and metallurgical operations in Algiers and Tunis. For the use of its mines and smelter in southern France, it has under construction a hydro-electric plant in the valley of the Neste d'Aure, to develop 10,000 kw. The net product from all operations in 1917 amounted to $2,799,723, from which there was applied to amortization and reserve the sum of $279,978, leaving a disposable balance of $2,519,808. Out of this was paid a regular dividend of 12½ francs per share on the capitalization of 292,500 shares having a par value of 250 francs each, or roughly $14,625,000. In addition an extra dividend of 27½ francs per share was paid, making a total distribution of 40 francs per share, or $2,350,000, being at the rate of 16%.

Mining Decisions

Suit on Adverse Claim—Evidence

In a suit brought to determine an adverse claim for patent when the issue was one of discovery of mineral and conflict of boundaries, proof of performance of annual labor or the $500 worth of work required as a pre-requisite to patent was immaterial and properly rejected.

Roberts v. Oechsli (Montana), 172 Pacific 1037.

Mine Lease—Responsibility for Machinery

Where the lessee of a mine agreed to operate continuously and "to keep the machinery in as good working order as when he took possession," his lease became subject to forfeiture when he did not re-build, within a reasonable time, the mill which was practically destroyed by an unusual flood, even though he continued to mine free ore after the destruction of the mill and to pay royalties thereon.

Bradley v. Holliman (Arkansas), 202 Southwestern, 469.

Texas School-Lands—Mineral Rights

Under the laws of Texas the owner of mineral rights in school-lands under a State permit must comply with certain requirements specified or have his rights forfeited. Held, that failure to comply with the requirements does not 'ipso facto' work a forfeiture, but the forfeiture takes place only when the Commissioner of the Land Office indorses a termination of the permit upon the duplicate on file in his office. Mandamus will not lie to compel this indorsement.

Underwood v. Robinson (Texas), 204 Southwestern, 314. June 28, 1918.

Conversion of Ore—Shipping and Smelting Charges

In an action for the conversion of ore, in the absence of pleading and proof as to the cost of shipping the ore or the charge for smelting the ore, an innocent purchaser for value from persons who had taken the ore from plaintiff's claim by an unlawful trespass thereon is not entitled to a recovery of the shipping and smelting charges. A location made by persons on ground already covered by a valid existing location upon which annual labor has been performed is void and the attempted re-locators are in the category of trespassers.

Kelvin Lumber & Supply Co. v. Copper State Mining Co. (Texas), 203 Southwestern, 68.

Severance of Minerals—Effect of

Ordinarily, oil and gas while in the earth are not the subject of ownership separate from the soil, but the owner of the land may dismember his ownership and sell his land, excepting and reserving to himself the oil, gas, and mineral rights therein. The right to such severance is not affected by the migratory character of oil and gas, if the oil or gas flow from beneath the land, the value of the reservation is diminished 'pro tanto' but not the right to take such oil or gas as may be found there. The right to take minerals thus reserved becomes a separate entity, and its ownership is attended with all the burdens and incidents peculiar to the ownership of land.

DeMoss v. Sample (Louisiana), 78 Southern, 482.

The American Smelting & Refining Co. reports a net income from all sources for the first half of 1918 of $9,745,526. This is a decrease of $9,012,374 when compared with the same period of 1917.

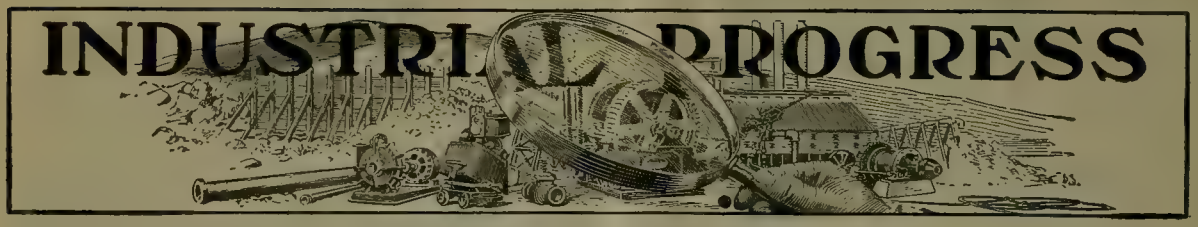
Book Reviews

International Mining Law. By Theo. F. Van Wagenen. Pp. 342, index. McGraw-Hill Book Co., Inc., New York; Hill Publishing Co., Ltd., London, 1918. For sale by 'Mining and Scientific Press'. Price, $3.50.

This readable and attractive volume presents the mining laws of the world mainly in an abstracted form, and also treats the subject from a comparative historical standpoint. It is many years since a work has appeared in English covering this field and this is the first work of its kind to appear in the United States. 'Walmesleys Guide to the Mining Laws of the World' (London 1894) has long been out of print, and Alford's 'Mining Law of the British Empire' (London 1906) is limited in scope, as its title indicates. There is in this country a pathetic ignorance of foreign mining laws and of the principles underlying mining law in general. The recent widespread agitation for a profound revision of our own mining statutes has revealed remarkably little well-considered thought on the subject. Few possess ideas more inclusive than a demand for the repeal of the extra-lateral and discovery provisions of our existing laws, and no satisfactory workable substitute for these ancient and venerable doctrines has been suggested. Before we tinker with laws that have been the outgrowth of the American miners' own conception of what they should be, we should know at least what other countries have done in similar legislation.

The author states in his preface that: "Practically all the raw material in this volume was collected primarily for the purpose of enabling the author to form an intelligent opinion as to whether the American Federal Mining Law was in need of revision, and if so, in what respects." He finds the fundamental principles of the American system of mining law to be sound and, on the whole, to present a workable and democratic system, comparing favorably with those abroad, and, if judged by practical results, to vindicate its existence. He favors ownership of mining claims in fee simple as opposed to the leasing system, and emphasizes the important part the prospector plays in this country, whose activities, he feels, should be still further encouraged. It is regrettable that he did not select a more accurate title for his work. International Mining Law implies one system of mining law common to nations generally. It is extremely doubtful, if the League of Nations should become a reality and the now shattered fragments of international law should be gathered together and placed on a firm and unshakable foundation, whether mining law will receive any consideration whatever as a subject meriting international attention. What the author doubtless intended by the title is rather Mining Laws of Nations, or Mining Laws of the World.

We note a few inaccuracies of statement, such as, "unpatented mining claims are not taxable by the State" (the Supreme Court of the United States has held otherwise); the Federal law only "inferentially requires" discovery, (as to lode-claims the Federal Statute is specific on this point). We cannot always concur in his conclusions, and at times he is inclined to speculate to a degree not warranted by his premises. For example, there is no reliable data to justify his statement that the extra-lateral right probably had its root in the laws of the Roman Empire. We also regret that, in a work possessed of so many excellent features, he does not, with rare exception, cite the authorities upon which he bases his statements. In spite of these minor criticisms the work is well worth while. It occupies a place in the literature of mining law that heretofore has not been represented in America, and deserves attentive study by everyone who is interested as mine owner, operator, or mining attorney. This was referred to editorially last week.



INFORMATION FURNISHED BY MANUFACTURERS

COMMERCIAL PARAGRAPHS

The Giant Mineral Co., Louisville, Kentucky, is planning for the development of a fluorspar property near Marion. J. B. Riley is president.

The Dominion Feldspar Co., Rochester, New York, affiliated with the Rochester Feldspar Co., has broken ground for the erection of a new two-story plant on the Genesee river.

The Gulf Sulphur Co., Bay City, Texas, has increased its capital from $250,000 to $750,000 for proposed extensions. The company has also filed notice of change in name to the Texas Gulf Sulphur Company.

The Solvay Process Co., Syracuse, New York, is preparing for the erection of a new plant for the manufacture of picric acid near Grand Rapids, Michigan, to cost over $1,000,000. The works will be used for Government service.

The Federal Mica Co., New York, New York, has been incorporated with a capital of $25,000 to operate mica and kindred properties. G. L. Ambert, D. S. Dushking, and E. A. Gersbach, New York, are the incorporators.

The Rare Metals Reduction Corporation, Newark, New Jersey, has been incorporated with a capital of $20,000 to operate a metal reduction works. Julius Cuter, 7 Hinsdale place, and Henry M. Snitzer head the company.

The International Graphite Corporation, Richmond, Virginia, recently organized with a capital of $7,500,000, is planning for extensive operations and development work in graphite properties. Thomas B. Gay is president.

The United States Manganese Corporation, 50 East 42nd street, New York, is rushing construction in extensions to the milling plant of its subsidiary, the Butte-Detroit Co., at Ophir. The plant will be used for the handling of manganese ore.

The American Sheet & Tin Plate Co., Frick building, Pittsburgh, Pennsylvania, has completed plans for a tinplate mill to be constructed near Gary, Indiana, at an estimated cost of $10,000,000. Bids for the erection will be asked at once.

B. H. Tripp, special representative of the **Chicago Pneumatic Tool Co.**, on the Pacific Coast, has succeeded M. W. Prieseler as district manager of sales for the Pacific Coast territory. His headquarters are at 627 Howard street, San Francisco. The Los Angeles branch of the company, at 251 Title Insurance building, comes under Mr. Tripp's jurisdiction.

In connection with the installation of a battery of 300 by-product coke ovens, of the Koppers type, at the Eliza furnace of the **Jones & Laughlin Steel Co.**, Pittsburgh, Pennsylvania, arrangements have been completed for the erection of a number of new buildings to cost $390,000. About $750,000 has been expended to date for property in this vicinity.

The Wood Equipment Co. has recently purchased and equipped commodious shops at Grand Crossing, Chicago, in order to provide increased facilities for manufacturing the pneumatic rotary dump and other mining specialties. The main offices will be at that plant, and the company will continue to maintain a city office in the McCormick building, Chicago, as well as branch offices in New York, Pittsburgh, Knoxville, and Denver.

The Chicago Pneumatic Tool Co. announces that a contract has been let and work started on the erection of an up-to-date addition to its Cleveland plant, to double the present output. It is expected that work will be completed on the building about November 1. The necessary equipment has been ordered, and it is believed that it will be delivered and ready for installation by the time the building is completed.

The Birmingham Steel Corporation, Birmingham, Alabama, has commenced construction of its new steel works at North Avondale, near Birmingham. The initial unit will cover an area of approximately 5 acres. The company has filed notice of an increase in its capital from $1,000,000 to $5,000,000, to provide working-capital for the project. The plant will specialize in the production of fabricated steel sections, a large portion of which will be for the Mobile Shipbuilding Co. Henry Leon Brittian is president of both organizations.

The Lunkenheimer Co. of Cincinnati, royally entertained the delegates and visitors to the N. A. S. E. National Convention held in Cincinnati during the week of September 9. The company obtained permission to use Cincinnati's wonderful Zoological Gardens on Wednesday afternoon and evening for their outing. Amusements were arranged by Lunkenheimer representatives. The vaudeville was particularly enjoyed, especially the ice-skating upon the only outdoor artificial ice-skating rink in the United States. The performers were the best that the profession afforded and were brought from Chicago solely for this affair. Dinner and other refreshments were furnished gratis to the delegates and their friends by the Lunkenheimer company. Over 1500 people were entertained.

The Nevada Engineering & Supply Co., of Reno, Nevada, announces an extensive list of machinery and equipment suitable for mines, mills, and shop, ready-to-deliver, and available for shipment at Reno, with a special circular announcing equipment suitable for gold milling or crushing for flotation, now on hand and ready to ship at Wabuska, on the S. P. railroad in Nevada. In these days, when mine equipment is hard to obtain, even when priority orders are issued, the chief reliance of new enterprises necessarily is upon second-hand supplies. The manager today does not scrap old equipment with the glee that used to scorn the opportunity to repair and conserve. Old machinery has become precious, and the services of companies that collect and make available the old appliances are deeply appreciated. The catalogue of a second-hand supply house has come to mean as much, and, if time is a serious item, to mean even more than the announcements of the original manufacturers.

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Edited by T. A. RICKARD

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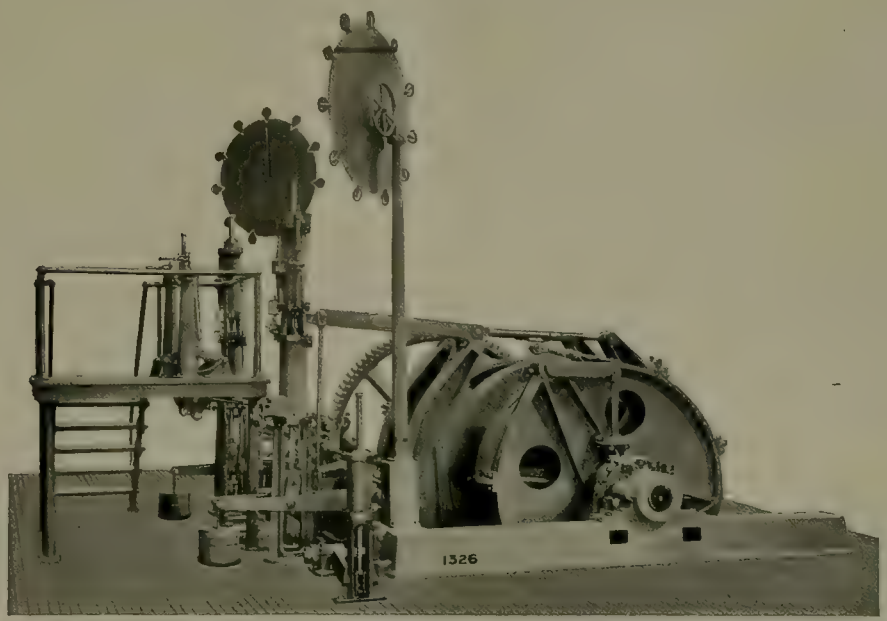

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EDITORIAL STAFF

T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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E. H. LESLIE, *600 Fisher Bdg., Chicago*
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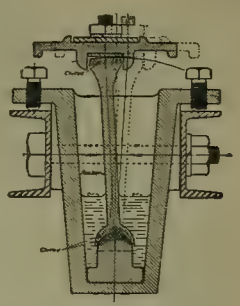

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THE President, in his note of October 14, informs Germany what it means to accept our terms of peace. Concurrently he states that 250,000 soldiers are to be sent monthly to the front. No armistice is granted. So far, so good.

GERMAN brutality does not diminish on the eve of their military collapse. The scenes enacted when the 'Ticonderoga' was sunk by a submarine were the most horrible since that fateful day when the 'Lusitania' was assassinated by the same set of pirates. After the 'Ticonderoga' was fatally disabled the Germans shelled the passengers trying to escape in the boats, and again while the vessel was disappearing under the waves they shelled the one lifeboat that had been launched successfully. Are these the people that are to escape punishment by shrieking 'Kamerad' as soon as they see themselves beaten; or ask for an armistice in order to reorganize their shattered armies?

AS a measure of the marvelous growth of the chemical industry in the United States, Mr. Charles H. Herty, in his report as chairman of the Advisory Committee to the Chemical Exposition held in New York last month, presented a comparative statement of the exportation of four commodities for the fiscal years ending June 30, 1914 and 1918, respectively. The figures are impressive. Sulphuric acid increased from 6000 to 34,000 tons, caustic soda and soda ash from nearly nothing to 334,000,000 pounds, benzol from nothing to 25,000,000 pounds, and dyes from a value of $357,000 to $17,000,000. The Government has expended $198,704,000 in the production of materials for gas-warfare. The preparation of potash salts has grown from 1000 tons in 1915 to 32,000 tons in 1917. The trade-mark of the future will be 'made in America'.

EXCESSIVE optimism is playing into the hands of the Enemy. Wild talk about the War being over before Christmas is bound to slacken the efforts being made to bring the War to the only conclusion that will retrieve the calamities it has brought on civilization. Pro-German propagandists are busy in our midst for the purpose of relaxing the force of the Allied attack. For example, here in San Francisco there have been spread rumors that the banks had been ordered to prepare for peace and that an order had been issued from Washington to stop ship-building. These are lies circulated by friends of the Enemy. All good citizens should not only refuse to give credence to such stuff but they should denounce them promptly. When the War will end no man knows, but we do know that if we are to end war we must see this one through to a definite conclusion, and that means the complete and irretrievable defeat of the aggressor.

IT is announced that the Dominion government has approved an investigation into the rates levied by the Consolidated Mining & Smelting Company of Canada for the treatment of ores at its Trail smelter, in British Columbia. The committee of investigation consists of Messrs. S. S. Fowler, Ivan D. Lachmutt, and James Anderson. We feel assured that under Mr. Fowler's leadership this committee will act fairly, so that if anything is wrong it will be disclosed, and if the conduct of the smelter people is correct they will be fully exonerated and suspicion allayed. We trust that the investigation will be more convincing than the one made in Colorado by the committee appointed by the State legislature last year.

HOW insincere are the protestations of our discomfited Enemy is made clear by his continued efforts to destroy and devastate the invaded countries from which he is being compelled to retreat. The destruction of the great coal-mining region in northern France, roundabout Lens, Douai, and Cambrai, is horrible. The Germans are taking pains to commit as much wanton sabotage as time will permit; they are destroying the mines, the cities, and more particularly the public buildings, looting as they go backward. In Belgium they are collecting all the cattle and foodstuffs belonging to the emaciated population and compelling the young and old alike to do their dirty work. What is the use of listening to 'defensive' talk and 'protection of the fatherland' so long as they continue their merciless marauding and bestialities. It is time for the Allies to notify the German government, that is, the Kaiser and his nominees, that the officers giving orders to perform these acts of vandalism will be held to personal account and brought to proper punishment when the hour of accounting arrives. The theory of personal responsibility is one that should be enforced as against the Kultural notion that a man is justified in surrendering his conscience to his superiors. The British

government did well, when the naval attaché at Petrograd was killed, in notifying the leaders of the Soviets that they would be held personally accountable for this murder and for others they might commit. Civilization revolts at the Prussian idea that any atrocity is permissible in time of war, especially on the losing side. Among nations, as in a community, we must assert the principles humanity has toiled to establish since emergence from the jungle.

TO demand indemnity from Germany is to pardon her crimes and to let her go with a fine. A Germany left so consolidated, so integral as an empire or as a representative government, that it can finance a payment of indemnities comparable to the magnitude of the depredations and damage done, is still a great, powerful, and dangerous Germany; it is still a potent force for evil and disruption, merely stung by defeat, not crushed and humbled; it is still a nation full of the consciousness of power, of which the indemnities constitute a measure; it is merely a nation with its ideals of world-power baffled, not blasted. Its pride would be hurt, its desire for revenge would color every one of its future acts. The gold paid over, under duress as indemnity, would become its boast of greatness, its demonstration to on-coming generations of ability in the future to wipe out the defeat of 1918 by forcing the world to accept the Pan-German yoke. When Bismarck defeated France in 1871 he imposed upon her an indemnity so great that all men thought it involved the collapse and downfall of that nation, but it proved only a stimulus to industry and thrift. France paid it, and laughed as Hercules laughed at the penalty imposed for his affair with Linus; his exile merely offered the opportunity to begin the twelve labors that covered his name with mythic glory. The nation that Bismarck believed he had crushed with a mountainous financial burden met the helmeted barbarians of 1914 at the Marne with a shock that shattered their dreams of conquest, and saved the world from destruction. We must beware how we measure in terms of money the things that are above or beneath barter and sale. A fine imposed is not an indignity; it is only putting a price on the thing that is called in question. We must not forget that the Germany of Bismarck used the plausible excuse of a plotting emperor as its *casus belli*, but it assessed its damages upon the French after their emperor had become a prisoner at Wilhelmshöhe, while they themselves were in the throes of re-organization as a republic. Not thus are nations humiliated. Even in finance the great names derive more honor and power from the magnitude of their liabilities, while they are in full career, than could come from the inactive balance after liquidation. Let us not commit the error of negotiating with a brigand people that is simply halted in its campaign of loot. France could boast of her innocence and her recuperative power, and she stood for civilization; an uncrushed Germany would boast of its power, in paying for trespass, with that age-old jeer of the savage Goth, unashamed, and unconscious of sin. On to Berlin!

Keep Faith With the Dead

All thoughtful men, particularly those whose kinsmen have made the supreme sacrifice, have realized increasingly as the War has progressed that the loss of life was a calamity that would become an unspeakable tragedy if it were made in vain. England and France have each a million dead on the roll of honor; we have lost comparatively only a few as yet, but they are dear to us and they seem many already. The iron has entered the soul of America. We are now in a position to sympathize with steadfast England and gallant France whose heart's blood has been poured continuously during four long years in the heroic effort to hold the enemy and to drive him back across the frontiers of freedom. Daily the casualty lists grow; we realize more and more the seriousness of the part the United States is playing. Out of suffering this nation is being made strong in spirit as in material resourcefulness; by sacrifice this composite people is being welded into a unit in preparation for its destiny as a liberalizing force in civilization. All this depends, however, on the fulfilment of one condition: that we hold firmly to our aim, which is to end war by making the aggressor in this war so sorry that he started on his campaign of aggrandizement that he will be forever unwilling to repeat the attempt and that others will be forever deterred from imitating him. There must be no more imitators of Alexander, Charlemagne, Napoleon, or Wilhelm II of Hohenzollern. That in itself is reason enough for seeing this thing through to the very end, namely, the complete defeat of the Enemy and his disarmament; but there is a more binding obligation upon us than even the restoration of international law, big as that is; we are deeply bound in honor to keep faith with those that have died for us in battle. They gave us their inspiration and their trust, their services and their lives; if we fail to complete the task to which they dedicated themselves then our roll of honor becomes a record of failure, a memorial of bad faith, a reminder of the pitiable wasting of the flower of the race. The one thing that can redeem the horror of the last four years is the assurance that the world will never again be subjected to such a holocaust. If that assurance be wanting, by our coming to terms with the aggressor, then all the suffering and loss will have been in vain. For what did those millions die? For what were Belgian babies killed and French women dishonored; for what were strong men driven into captivity and returned the pitiable husks of life; for what did the wounded British soldiers suffer tortures from devils incarnate and our American boys drain the cup of sacrifice? Do we owe nothing to them, shall we so soon forget our debt to the dead? The gallant men that stormed the gates of hell were glad to die because they believed that their lives were not wasted; they were proud to die because they felt confident that their task was done and that their cause would triumph. Have we the courage to face the hosts of the dead and tell them that they died for naught? Shall it be "in vain" or "never again"?

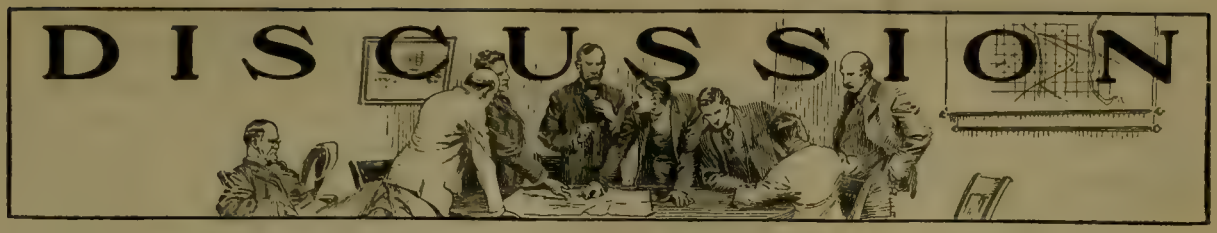
Kamerad?

The German government—whatever that may be—has accepted the conditions of peace laid down by the President of the United States on January 8, 1918. The news was flashed around the world on October 12 and immediately called forth the most eager questioning of its real meaning. At that very moment the newspapers that brought the news were full of accounts of German sabotage and brutality in the regions over which their defeated armies were retreating; they also quoted Sir Eric Geddes, who, speaking for the British Admiralty, informed the American public that a great renewed submarine campaign on the part of the Enemy was impending. Many doubts arise, and the chief of which are these: Has the government of Germany passed out of the hands of those responsible not only for the War but for the bestial manner in which it has been waged? Are the Kaiser and his henchmen still the real power behind the present Chancellor and the Foreign Secretary? Is it Jacob or Esau that is speaking? What proof is there that we are talking peace with the representatives of a repentant German people? Having brought untold horror and calamity upon the world, and having failed in their insane ambition, is the German people so sorry as to be determined never again to support a similar criminal enterprise? Are we going to sheathe the sword and come to terms with the bloody aggressor merely because he sees that his dream of world dominion has been frustrated? Is Germany penitent or only foiled; is she merely willing to hood her claws until a more convenient opportunity arises? These claws must be cut, they must be removed to the roots, lest the beast re-assert herself at the next chance. We have a hundred reasons for doubting the sincerity of Germany; every move made by her is suspect; the whole proceedings savor too much of the 'kamerad' performance in battle, when a Hun, having killed as many of our men as he can, raises his hands in surrender in order to escape his logical fate. So did Bulgaria: having massacred the Serbians, Montenegrins, and Rumanians; having devastated and despoiled the lands of her neighbors under the protection of the German armies, she capitulated at the very moment when her own country was about to be invaded and she was to undergo the logical punishment for her actions. Bulgaria escaped justice; is the bigger criminal to be allowed a similar immunity? Having broken every international law, having become an outlaw, is Germany to be treated as an honorable antagonist? These are some of the questions that must have exercised the minds of thoughtful men last Sunday, when this was written. The President's famous Fourteen Terms are familiar now to everybody. When he enunciated them he probably had no expectation that they would be accepted so soon at their face value. The German government—whatever that may be—appears to have accepted them in fear that the conditions to be imposed by the other Allies might prove even more exacting. Much remains to be defined. The terms numbered VII and VIII, for example, require specific interpretation. "Belgium must be evacuated and restored." What does "restored" mean? Does it mean, as it should, the reconstruction and rehabilitation of the bridges, railroads, cities, and public buildings of that innocent victim of Prussian frightfulness? Does it mean the return of, or compensation for, the money, supplies, and material removed from Belgium to Germany? For the dead manhood and outraged womanhood of Belgium the Kaiser and his people can make no recompense; for these they will account to history and to the God whom they have blasphemed continuously. Is the burglar to be compelled to give back the stolen goods, after having murdered the women and children in the house? Again, "All French territory," says the President "should be freed and the invaded portions restored, and the wrong done to France by Prussia in 1871 in the matter of Alsace-Lorraine should be righted." What do "restored" and "righted" mean? Is indemnity to be given for the incalculable sabotage perpetrated by the brutal armies of the Hun? Will they replace the machinery they took from the great industrial centres of France, the statues they melted for making munitions of war; will they re-build the cathedrals they shelled wantonly and systematically? More important still, will they give to France an amount of iron ore equal to that extracted by them from the mines of the Longwy-Briey basin? Does the "righting" of the wrong done to France mean specifically the unqualified restoration of Alsace and Lorraine to that country, with compensation for the millions of tons of iron ore that Germany has taken out of Lorraine for the purpose, *inter alia*, of making guns, rails, and equipment wherewith to attempt the complete subjugation of France? The President has enunciated conditions of peace such as might be addressed to a repentant Germany, to one that had decided to throw the Hohenzollern dynasty on the scrap-pile of belated anachronisms, to one that saw the error of its ways and was anxious to rejoin the comity of civilization; is he talking to a penitent or only to a burglar merely eager to escape punishment? We abide the issue, confident that in this supreme hour he will act so wisely that what he does will win the support of this country, the approval of the Allies, and the commendation of posterity.

The Government's Duty to the Miner

The War Minerals Bill, as useful legislation, may be dismissed from the mind of every miner who had thought to help his country by responding to the call for chrome, for manganese, for pyrite, to name but a few. We believe that the bill purporting to care for these industries has been agreed upon by the conferees of the two houses of Congress, and been approved. As the President is not a miner, we may exonerate him; he cannot know everything, therefore we can understand that he does not know how the signing of this piece of class-legislation dashes the hopes of thousands of poor men who thought that they had a right to make a dollar by patriotic service as well as did the presidents of sundry corporations now disporting themselves under a dollar halo. We realize

that a plausible technical defence of the bill can be made; the difference between the letter and the spirit of the laws has been long acknowledged; this bill offers one more example of that notable difference. Since we must lay aside all hopes of a straightforward democratic measure, honestly validating the appeal made by the accredited bureaus of the Government when they begged miners to produce chrome, manganese, pyrite, and other war-minerals, the question of national duty should be considered. Even if it be conceded that the Government at present is in such a position that it would be inexpedient to bid the prospectors to continue the search for these minerals under a guarantee to accept, at a fixed price, all the ore they might dig and ship, that has nothing to do with the moral responsibility already incurred. When the bureaus and committees at Washington, some months ago, undertook to stimulate production they set no limit; they made it a mark of patriotism for the miners to respond by delving in the earth and flinging the ores to accredited users for Government account. In line with these urgent appeals the original War Minerals Bill was drawn, meeting exactly such obligations as had been assumed through these blanket orders. Naturally people thought that the officials meant what they said. The War must be won; these minerals were essential to winning it; ships were not available for bringing such material from foreign countries; therefore a man was justified in spending his time, in consuming his nest-egg, or in availing himself of his local credit, to produce these supplies for Uncle Sam. Time was of the essence of the contract, for the War was upon us, and armies that wait are lost. What would you call those pleading letters and telegrams from the War Industries Board and the Bureau of Mines, if they were not in the nature of contracts? As constituted officials of our Government they spoke for that Government, and they told the miners in plain English to make haste and produce! In business that would be esteemed a 'firm order,' if it came from a reputable house. If Mr. E. G. Grace of the Bethlehem Steel Company should wire you to mine and ship him all the manganese you could produce, at a fixed rate, would you feel it necessary to await confirmation by an instrument duly signed and sealed by the executive committee? How long would it take the Board of Governors of the New York Stock Exchange to declare forfeit the seat of a member that had signaled, above the din and confusion of the pit, his acceptance of a quotation for a block of stock and then had repudiated his bargain? The people of the United States are just; they believe in the sanctity of contract, and they do not hold it clever in their representatives to pretend to save a dollar for the Teasury by making the Government play false to its engagements. We are having a startling illustration of the serpentine beauties of bureaucracy! The method of building an organization for war-supplies from an unpaid personnel of men who represent primarily the interested industries is wrong in principle. It has provided a camouflage of patriotism for the profiteers. A man should be paid for the service he renders, and be held accountable to the people for rendering it. Our view of the case is sustained by men of all shades of political faith. This is how it appears to one prominent committee-man in Washington: "First, as to the War Minerals Bill, I agree with you that it has been emasculated until it is of small value. The truth is that it has been killed by the bigger corporations of the country or by the men who run them. . . . The way this Bill has been antagonized by men whom we respect for what they have done in other things, who yet seem to be incapable of divesting themselves of their previous selfish competitive instincts, is grievously disappointing. You know these men, as well as I. . . . It is lamentable how the selfish obstruction, first raised at a meeting of a division of the American Mining Congress, subsequently kept alive by one of their men who camped in Washington and attended practically every hearing of the committees on the subject, acting as lobbyist, and cross-examining witnesses, followed by the attacks of the now president of the Anaconda company . . . have caused delay and amendments." We leave it to others to fight the battles of the wronged food-producers; they have their organs, and their difficulties meet with our sympathy because they resemble those of the metal-miners whose rights it is our special province to defend, especially prospectors. These build the foundations of the mineral industry, because their work constitutes its beginnings. This time it is the small miner who has been unjustly treated. Unscrupulous men have abused the authority given them, and the result is that financial ruin threatens an army of hard-working prospectors and miners. This must not be. The Administration is eager to keep its record clean as the champion of democracy, and it dare not allow such injustice, undertaken for the gratification of corporate greed, to stand unrighted. Every man who has tried to find and produce chrome, manganese, or other war-minerals, and has suffered by reason of the failure of the authorities at Washington to sustain his efforts, should submit a brief statement of the facts; our own discussion columns are open to all, and can serve no better purpose than to present information of this character, subject to verification, for the sake of letting the Government and the people know the manner and extent of the injury done. Given an Act that will admit of making contracts for the minerals needed, the administration of that Act can be so directed by a ruling of the War Industries Board, or by special legislation, which the Administration should endorse as an urgent measure, as to ensure that those already involved, by having actually made ready to deliver ore, shall receive consideration through acceptance of their product under terms and prices that will enable them at least to come out even. We cannot believe that the representatives of our Government, at a critical moment in a war for democracy, will allow deserving men among the plain people to be financially crushed in this manner. The Government will not fail to note that a small group stands ready to win enormous profits on an accumulated stock of ore if this widely distributed competition, which arose in answer to the call of patriotism, shall be demolished. Whether the War continue or not, justice must be done.



The Chromite Crisis

The Editor:

Sir—The writer's attention has been called to an extract from your magazine of September 28, in regard to the chromite situation.

The writer hardly sees how your magazine feels justified in making the comments that are quoted from this article without knowing any more about the facts, or investigating the facts further than you apparently have done. In this article you state you will defer further comment, but we think it would have been a good deal better taste if you had deferred the comment that you did express until you knew the real chromite situation.

The writer himself, does not usually comment on magazine articles, but the reference to "greed of those in the ferro-alloy industry" as causing the present chromite situation is so uncalled for, and so unjustified, that in the writer's opinion it seemed proper to make this statement in a letter to you.

It might be also stated that you have not correctly quoted the advertised policy of the War Industries Board in regard to chromite. The announcement reads as follows: It is the present intention of the War Industries Board to arrange for continued chromite production in the United States for the first half of 1919 at a rate proportionate to the rate of 1918 production, and the trade will be asked to purchase chromite of suitable grade produced in the United States, during the first half of next year at this rate. We believe the tonnage of domestic chromite produced the balance of this year of suitable grade can be sold at the average price paid this summer by the California Chrome Co. If unable to find ready market for ore, wire this office giving tonnages ready for immediate delivery and guaranteed analysis and prices wanted, and to whom already offered and refused.

HUGH W. SANFORD, Chief,
Chemicals Division, Ferro Alloys Section.
War Industries Board, Washington, October 3.

[Mr. Sanford credits us with less knowledge of "the chromite situation" than we happen to possess; most of it, unfortunately, we are not permitted to use, otherwise we would publish it, at once, without hesitation, in the public interest. Our reference to the greed of those controlling the ferro-alloy industry was made deliberately, and, we believe, is fully justified by the facts. We do not care to dispute over questions of taste with Mr. Sanford, but we are glad to publish his statement concerning the present intention of the War Industries Board.—EDITOR.]

The Editor:

Sir—Referring to the article in your issue of October 5, page 437, covering (or touching upon) the inefficiencies of the War Industries Board, the Government Labor Bureau, and the so-called Power Administrator, I suggest that pure patriotism and proper consideration for the public welfare really demand full and continued publication of the various acts of the officials handling these and other commissions from the Government. It is no time to doubt, in the very mildest manner, the good intent of the Government in controlling such industries and public utilities as it may see fit; as true Americans we should all back the Government's action to the limit, even at serious personal loss; but, it is certainly no part of patriotism to overlook or gloss over the malfeasance of the officials, appointed so generally on political grounds, representing the Government in these matters.

When the Government decides to control certain industries, the decision is doubtless the result of long and arduous study and consideration; but, at this point its responsibility is by no means ended, it is only begun, for the entire value of such Government control is dependent upon the efficiency and honesty of the commission appointed to carry out the Government's intent. Our aeroplane fiasco is something we all wish to forget, as a supremely important issue dishonestly handled; and we cannot overlook the fact that practically all of the war issues, such as affect our labor conditions, our food, etc., have affected the millions left at home in a vastly different way from that which the Government most certainly intended. It is probably true (and only natural) that Washington's principal, or only, knowledge of the inhabitants of the various States is covered by the political importance of such people, and that those who lack appreciation of political prominence are unknown and esteemed of little worth. This fatal error naturally places Government commissions in the hands of important State politicians, who, in turn, pass out the subordinate offices to county and municipal politicians; a process which, very naturally, prostitutes justice to personal greed. Emerson once likened politics to "one of the poisonous handicrafts, deleterious alike to the worker and the populace"! How much did he err?

It is an unfortunate fact that most of our newspapers and journals are politically subsidized, and afford no open channel for exact publicity. We are on the eve of a huge expenditure to assist the production of a group of less-known metals. What advantage may we expect from this if the handling of these fifty millions is not carefully scrutinized, and if the clearest light of pub-

licity is not turned on by some honest journals? Just what care has been exercised by the Bureau of Mines to see that the local work in mining centres has been placed outside the shadow of the political upas-tree, and in the hands of men sufficiently honest and capable to make this expenditure something other than a fiasco? Why cannot the Mining and Scientific Press extend its definite knowledge of the matters calling forth this article, and turn on the searchlight?

F. C. Smith.

Chloride, Arizona, October 6.

[We are glad to publish this letter, but we desire to state that "the local work in mining centres" in behalf of the U. S. Bureau of Mines is, as far as we know, in excellent hands; certainly, it is in efficient and trustworthy hands in California and Oregon.—Editor.]

International Mining Law

The Editor:

Sir—Apropos of Mr. Van Wagenen's work on this subject, I desire to express the hope that our law may be modified so as to permit the location of claims in the United States by citizens of such nations as accord similar rights to us without the necessity of changing citizenship or allegiance. Should this suggestion be adopted, it would be well to annex the condition that the annual assessment be inspected and recorded by a Federal official. It would not be amiss if this were done now, since it would discourage the holding of an excessive number of claims for speculative purposes. The recognition, in this manner, of the liberal and friendly mining policy of our Latin-American neighbors and of other nations, can but promote a better mutual understanding.

F. W. Carnahan.

San Francisco, October 8.

Gold Production

The Editor:

Sir—The much debated question of how to stimulate the production of gold is a matter that has occupied my attention for a long time back, and I have read with interest the article published in your issue of July 20 and also the suggestions of numerous correspondents in subsequent issues. It seems to me one way in which domestic production could be stimulated has so far been overlooked.

At present this nation and others fix the value of gold for purposes of coinage but that does not determine its intrinsic value in the industrial arts. Could not the Federal government go further and commandeer all the gold produced at its present price and constitute the U. S. Mint the sole vendor of gold for jewelry, dentistry, and the arts generally? They could impose a 50% charge over and above cost on gold re-sold. To do this would require stringent laws to ensure all gold passing through the Mint. The effect would be that present manufacturers and users would pass the extra cost to their customers. It also would be necessary to have a heavy penalty for defacement of coinage. With the high rates of wages ruling I am of opinion the amount used for jewelry and dentistry would remain much the same as at present. The surplus derived in this way could be devoted to giving a bonus to all producers exceeding, say, 10 oz. standard gold per quarter. The object of fixing 10 oz. would be to lessen the cost of book-keeping. I should not be surprised to learn that gold used for purposes apart from coinage at present would account for 40% of the total production in the United States.

There should be no insuperable difficulty in obtaining an approximation of the gold consumed apart from coinage, and the extra money to be derived in the above manner should be of sufficient importance to give a great impetus to the industry.

Akin M. Nicholas.

New York, September 26.

Loss of Quicksilver

The Editor:

Sir—In the issue of April 6, 1918, I note that in the article entitled 'Loss of Quicksilver in Gold Mills,' by W. J. Sharwood, no data are given on the loss in Huntington mills; possibly the following figures from the operation of the plant of the La Luz & Los Angeles Mining Co., of Nicaragua, Central America, may be of interest.

The mill consists of six 3½-ft. Huntington mills; the ore is a soft altered shale, a considerable portion, locally known as 'manto,' being no more than a stiff clay; the screens used were 20-mesh on the average, the final product being about half a true slime and the other half sand, the gold fairly coarse and clean. Inside amalgamation was practised and each mill discharged upon a 4 by 16-ft. amalgamating-plate, set at an inclination of two inches per foot, the plate-area being between three and four square feet per ton milled per day. The yearly averages of amalgam recovery and quicksilver consumption were as follows:

	Amalgam recovery				Consumption of quicksilver fed based on oz. Troy per ton milled.
	Inside mills	Plates	Creek-bed sluicing	Two Pierce amalgamators	Quicksilver
Years	%	%	%	%	%
1911	60.69	37.17	2.13	...	0.214
1912	63.62	36.00	...	0.38	0.161
1913	62.07	37.31	...	0.61	0.145
1914	62.07	37.35	0.10	0.56	0.127
1915	64.63	35.09	0.27	...	0.167
1916	67.37	31.99	...	0.69	0.102
1917	59.60	39.55	...	0.70	0.142
Average	62.885	36.405	0.26	0.42	0.144

The recovery by amalgamation was from 60 to 75%, depending on the grade of the ore. The concentration of the amalgam was from 36 to 49%, being 43.74 as an average. The average bullion consisted of 840 parts gold and 150 parts silver. The bullion recovery was slightly more than twice the quicksilver consumption, which varied with the grade of the ore.

H. G. Smith.

La Luz, Nicaragua, May 8.

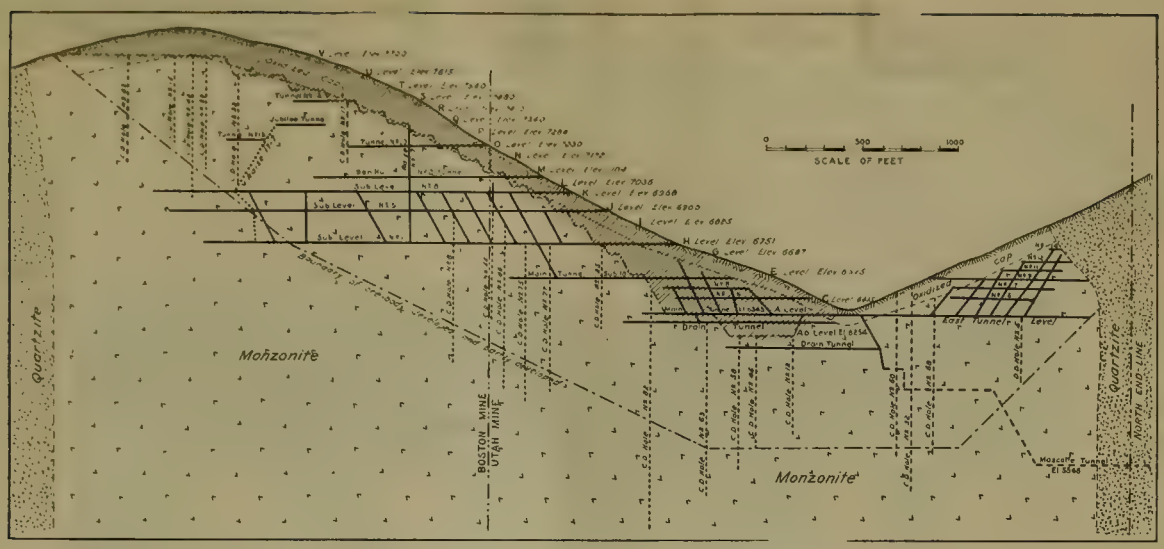


FIG. 1. CROSS-SECTION OF THE UTAH COPPER MINE

The Utah Copper Enterprise—III

The Mine

By T. A. RICKARD

INTRODUCTION. It was 5:25 a.m. as I lay awake expecting the call that was to arouse me from sleep. The air was vibrant with the singing of birds in the Temple gardens. That sounds poetic and Oriental, but, I hasten to say, the temple was Mormon and the singing of birds was the twittering of sparrows, holding their morning concert before the roar of city traffic drowned their effort to express the joy of life. The quiet of an unawakened community brooded over Salt Lake City. I started to dress, feeling superior, for at Ogden, only 38 miles westward, the hour was 4:30 and if the Daylight Saving law had not played fast and loose with Greenwich time it would have been 3:30. I felt like an early bird and had none of the qualms proper to the matutinal worm.

In due course, after breakfast at the Union Pacific station, I caught the 6:55 train for Bingham, which is at the far end, 34 miles distant, of the Bingham & Garfield railway. The sun was beginning to assert himself over the rim of the Wasatch range as the train started. Every seat was taken, for the train carried 700 men from Salt Lake City to their work at the mills on the other side of the valley. They looked like a pleasant lot of fellows, such, as, for example, one would not be afraid to be shipwrecked with. Most of them were reading their morning papers, of which Salt Lake has several, and of a good kind. The Hearst infliction has not been visited upon the Latter Day Saints, as yet. Looking around, I estimated that only 10% of the men were foreigners. They pay $10 per month for their commutation, which takes them daily to and from the Arthur and Magna plants of the Utah Copper company, at the foot of the Oquirrh range, which, with the Wasatch mountains, encloses this southeastern edge of the Dead Sea of America. The valley itself is cultivated with the thrift characteristic of the Mormon people, but much of it is marshy with salt water and defies reclamation. Soon I noticed an embankment like a railroad-grade on the left of the train and wondered what it was until I detected pools of green water at the foot of it. The effluent water was stained with copper; it was the tailing-dam restraining the discard from the big metallurgical works. This dam cut off the view southward, but the smoke now veiling the snow of the Oquirrh mountains suggested intensive industry. Soon the train enfiladed the series of buildings enclosing the Arthur mill, and more than half the passengers alighted. Within five minutes the Magna plant was reached, the train was reduced in length, and the remaining cars proceeded half-empty to Bingham. The railroad follows the eastern face of the Oquirrh range; the sun shimmered across the vast stretch of tailing, estimated at 65,000,000 tons averaging 0.5% copper, as dead metallurgically[1] as the salt waste that it blankets. Beyond Magna the country is more gracious; fields of young

[1]The Assessor for the county has made an effort to value this mass of tailing for taxation, even going so far as to place an arbitrary valuation of $50,000,000 upon it.

grain and alfalfa in clean patches of productive verdure fringe the saline plain at the base of the hills that mark the older shore of the shrinking lake. A group of buildings and a chimney belching smoke mark the settlement of Bacchus, a name not without irony in this 'dry' State, but signifying a stimulant more active than the juice of the grape, for at Bacchus is the Hercules Powder company's factory, producing the dynamite used at the big mine to which I am taking you.

The scenery was tame. The rounded hills, from which the snow had but lately gone, were freshly green. A train of 42 cars laden with ore passed noisily. The gradient increased; excavations on the higher slopes indicated the approach to a mining district; the canyon narrowed, on the opposite side I saw another line of railroad;[2] the train plunged through four murky tunnels and then emerged suddenly into the smoky obscurity of Bingham. The town itself was not discernible, the terminus being high on the mountain-side, and when I alighted I followed the other passengers into what looked like an elevator, but proved to be a tram-car running on a steep incline into the town. An inquiry proved that I had blundered, for the company's office was above, on the level of the railroad, so I ascended by the tram and found my way to the warehouse where Mr. J. D. Shilling, the superintendent of the mine, has his headquarters. My letter of introduction having been presented, I was conducted to the upper gate of the railroad-yard. Passing through the warehouse one could see barrels containing copper wire, to be used for the peaceful purpose of electric conduction; also copper rings resembling the bands that are put around shells, suggesting the warlike use of the metal. These rings, I ascertained, were 4-inch ferrules, used as a filling, or 'skim', at the point where the flues join the crown-sheet of the super-heaters of Baldwin locomotives. On the shelves was $30,000 worth of brass fittings for steam-machinery. Thus some of the uses of copper were indicated at the place where it was being mined. From the railway station one could see, through the smoke made by trains and steam-shovels, a mountain deeply scarred—the edge of the great mine—and from it, above the haze, a glorious flag flew assertively. That flag, 20 by 40 ft., cost $156, and was bought with contributions, of 25 cents to $1 apiece, made by the workers on the occasion of the campaign for the Third Liberty Loan. After a short walk along the railroad-track and over a viaduct, I reached the upper gate, where Mr. T. S. Carnahan (Columbia '05) met me and led me to the upper office at the mine itself.

Arriving at the office of the engineering staff, I noticed on a lower door a sign in Greek:

ΕΙΔΟΠΟΙΗΣΙΣ
ΔΕΝ ΧΡΕΙΑΖΟΜΕΘΑ ΕΡΓΑΤΑΣ

Nobody seemed to know what it meant, but upon entering the lower office it was explained that the first word stood for 'Notice' and the script meant that no laborers were wanted. The men employed at the mine are of many races, nations, and creeds. Of the 1800 employees at this mine, 600 are Americans and 1200 are foreigners, who are classified as follows:

Japanese and Koreans	416
Greeks	406
Italians	151
Armenians	72
Albanians	55
Fifteen other nationalities	100

THE MINE of the Utah Copper company is a mountain impregnated with copper ore—a veritable mountain of ore. Such has been the dream of the prospector from time immemorial. Mount Morgan in Queensland, Australia, was a mountain of gold ore, in so far as its summit was excavated bodily and sent to the mill, although now the output comes from a definite lode-channel within the core of the hill—500 ft. high—on which the outcrop was discovered. Mount Lyell and Mount Bischoff in Tasmania are the sites of big mine-workings that follow orebodies rich in copper and tin, respectively; Mount Davidson was enriched by the Comstock lode, and the Rammelsberg by its famous deposit of silver; but none of these was a 'mountain of ore' so truly as this great quarry, the face of which is 1500 ft. in vertical height and 3600 ft. wide at the base.

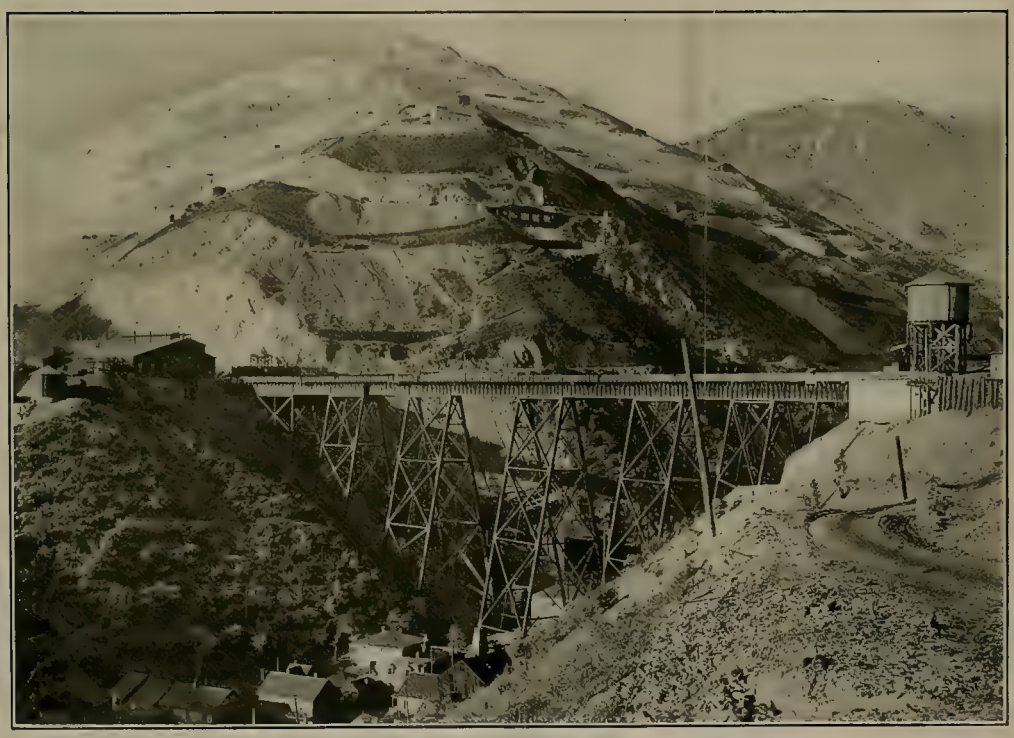
To realize the bigness of the mine, it is best to ascend half-way up the opposite hill-slope, on the east[3] side of Bingham canyon; there one faces the serried terraces that mark the successive slices now being cut out of the mass of copper-bearing rock. It is an impressive picture of highly organized human industry. The crest has been removed already, but, foreshortened by distance, the mountain still looks like a pyramid, the levels of successive excavation suggesting the step-like cross-section of one of the famous Egyptian tombs. The outer cover of the hill is colored red, by oxidation; the mass itself is gray. It is a huge theatre, in which the actors are 1800 men; but so big is the stage that they are hardly discernible at this distance. Ore-trains, like children's toys seen from afar, run along the levels and black steam-shovels vomit puffs of smoke as they dig energetically into the precipitous face of the artificial cliff. The smoke from the engines and the little black figures here and there give a touch of the infernal to the picture, but the suggestion is contradicted by the blue sky that canopies the scene. On top of the hill, like a redoubt, is a tank to which water is brought by gravity from Middle canyon, four miles west, to be conducted to the different levels for drinking, for the boilers, and for other purposes.

At noon, from this point of vantage, I watched the blasting. Before it begins, those in control of the operation on the various terraces indicate the fact that all is ready by blowing one long and three short calls from the whistle of a steam-shovel engine. When all have given this notification, the main whistle, blown by compressed air, sounds a general alarm, consisting of an irregular number of long and short calls. This is the signal for

[2]The Denver & Rio Grande, which transports 7500 tons of Utah Copper ore daily.

[3]The canyon runs north and south, except between the settlements of Upper and Lower Bingham, where its course is east and west for 1½ miles. See Fig. 2.

THE TABERNACLE AND TEMPLE, SALT LAKE CITY



THE UTAH COPPER MINE, WITH THE CARR FORK VIADUCT IN THE FOREGROUND

THE COPPER MOUNTAIN AS IT APPEARED IN JULY 1900, FROM THE JUNCTION OF BINGHAM AND CARR FORK CANYONS

THE SAME VIEW AS IT APPEARED IN JULY 1918

THE HEART OF THE UTAH COPPER MINE

STEAM-SHOVEL LOADING ORE INTO RAILROAD-CARS

AN INGERSOLL DRILL AT WORK

GENERAL VIEW, SHOWING THE TOWN OF BINGHAM IN THE FOREGROUND, THE UTAH COPPER MINE IN THE BACKGROUND, AND THE BINGHAM & GARFIELD RAILROAD IN THE CENTRE. THE WHITE DUMP ON THE LEFT IS PART OF THE OXIDIZED ORE OF THE 'CAP'; THE TERRACES EXTENDING AWAY FROM THE MINE WORKINGS ARE DUMPS OF 'STRIPPING', OR WASTE ROCK, IN GALENA GULCH.

the men in the pit to 'spit' their fuses. As soon as the men on the level above see that the fuses in the pit are lighted, they spit theirs, and so in succession up the series of levels or terraces. Meanwhile the main whistle continues to sound the warning at frequent intervals. As the blasting is completed each steam-shovel gives two long whistles, and when all have reported, the main whistle answers with two long calls, thereby notifying all the men on the hill that the blasting is finished.

First a series of shots is heard in the pit, these representing the blasting of big rocks—'block-holing.' Then a less noisy explosion is followed by a rush of broken rock down the face of one of the terraces. The most effective holes make the least noise. The rumble of running ground is heard above the successive explosions. Some of the holes emit smoke like a cannon. Fume and dust enliven the scene. Everything is on a big scale; as much as 25,000 tons of ore has been broken in one blast, of 10 or 12 holes. Soon the uproar shifts to the right shoulder of the mountain and over it to the other side, awakening fresh echoes in the background of hills.

South and eastward the levels are extended for the disposal of the waste that is stripped from above the ore, for most of the oxidized cap has lost so much of its copper by leaching as to be merely an overburden. At the beginning of this year 121 acres had been stripped ready for profitable mining, and 138 acres have been partly stripped. The dumps of waste represent a face of serrated ground almost as big as the mine itself.

It is a big mine in the open air. Winter does not seriously hinder operations; hardly 24 hours is lost per annum, although last winter twice, for half a shift during blizzards, it was impossible to move the ore-trains until the tracks were cleared by the snow-plow. Being open to the sky, the men are visible all the time; this is not without a salutary influence during labor troubles. There is nothing secret about these *al fresco* operations, which are always open to public view.

Geology. The mountain lies between the forks of Bingham canyon, the main ravine lying on the east side and Carr Fork on the west. Geologically the core of the deposit is monzonite, an igneous rock of porphyritic habit, that is, it has a groundmass of granular texture speckled by a characteristic mineral, like raisins in a pudding, in this case the phenocrysts being chiefly feldspar, but also biotite. Monzonite is a rock resembling granite; it is intermediate between syenite and diorite, the proportion of alkali feldspar (orthoclase) to soda-lime feldspar (plagioclase) being less than two-thirds and more than one-third. The monzonite-porphyry at Bingham has intruded from below into the older rocks, notably sandstone, but also limestone, in such a way as to bend or break the bedding-planes, changing the sandstone into quartzite and the limestone into marble. The plastic magma that, on cooling and crystallization, became monzonite exerted such pressure from below as to bend the sedimentary series into folds and other deformations, producing faults and fissures through which mineralizing solutions ascended. These solutions deposited their metallic contents as they approached the surface, where a lowering of temperature and a decrease of pressure favored precipitation. It has been shown by geologic investigation[4] that the deposition of the ore is closely connected with the intrusion of the monzonite into the quartzite, these two rocks constituting the prevailing terrain of the Utah Copper mine. It is likely that the process of enrichment was started by contact metamorphism, by which the copper minerals were deposited near the monzonite-quartzite contact and subsequently were segregated or concentrated at the contact and on both sides of it, chiefly in the monzonite, for a distance sufficient to begin the making of a big orebody. Hydrothermal activity, such as is the usual sequel to an igneous intrusion, caused mineralizing solutions to circulate along the fractures in the monzonite, particularly near its upper periphery, penetrating the mass of the rock so thoroughly as to effect a dissemination of metallic sulphides, namely, chalcopyrite and pyrite, over an area a mile long, as much as half a mile wide, and for a vertical distance of 2500 ft. All the augite and hornblende of the original rock have disappeared, most of the magnetite, and much of the feldspar. These minerals have been replaced, wholly or in part, by quartz, sericite, pyrite, and chalcopyrite. The replacement of magnetite by the metallic sulphides is the most significant fact. Some of the pyrite has been replaced by chalcopyrite.[5]

A later period of fracturing, followed by further hydrothermal activity, led to the formation of small veins of copper ore, together with an intense silicification and an increase of porosity throughout the mass of copper-bearing monzonite. As yet no mass of ore, that is, of rock rich enough in copper to justify mining, had been formed by the alchemy of nature. The copper was too thinly distributed to constitute 'ore' and would have been unworthy the miner's attention if a period of 'secondary enrichment' had not supervened. The intense fracturing of the rock had formed channels for the circulation of water from the surface; the sericitization, that is, the transformation of part of the feldspar into hydrous potash-mica, had increased the porosity of it; and the oxidation of the uppermost portion of the copper-bearing rock, by the seepage of rainfall and snow-water, had decomposed the chalcopyrite into soluble salts, which descended in obedience to gravitation and became precipitated at a lower horizon in such a manner as to augment the richness of the primary deposit. The secondary copper, precipitated by the reaction between the copper-sulphate solution and the primary chalcopyrite, took the form of the minerals covellite (CuS) and chalcocite (Cu_2S), the latter predominating in depth.

In order that an orebody of large vertical extent could

[4]'Economic Geology of the Bingham Mining District,' by J. M. Boutwell. Professional Paper No. 38, U. S. Geological Survey. 1905.

[5]J. J. Beeson. 'The Disseminated Copper Ores of Bingham Canyon, Utah'. Trans. A. I. M. E. Vol. LIV, pp. 356-401. This paper, published in 1916, throws new light on the genesis of the orebody, and I am indebted to it for much of my information.

be produced it was necessary that erosion should be less rapid than oxidation, thereby permitting the descent of freshly leached copper solution into the mass of primary mineral. That is what happened. The 'cap,' as now seen, consists of a few feet of soil and about 115 ft. of monzonite that has been leached, becoming brown, in contrast to the dark-gray color of the porphyritic copper ore, which extends to a maximum depth of 1800 ft. The average thickness of ore 'developed' and 'partly developed' at the end of 1917 was estimated officially at 538 feet.

The chemical reactions and operations by which the copper of the oxidized zone was leached and carried down so as to enrich the rock below is suggested by sundry observations made and recorded[6] by Mr. Beeson. When the cap is removed and the gray ore-bearing rock underneath it is freshly exposed, the gray ore appears wet, owing to the sulphate solutions percolating from the cap. In a short time the face of rock shows a green stain, extending for 20 inches[7] vertically, and in the course of a few days the evaporation of this acid moisture leaves a thin coating of crystalline copper sulphate. Again, Mr. Beeson noticed how a churn-drill, penetrating 45 ft., remained "scoured and clean" so long as it was in the brown cap, but in approaching the contact with the unoxidized rock it became spotted green, and when the drill had penetrated deeper it showed a coating of native copper, which must have been precipitated in the four or five minutes elapsing between the stopping and hoisting of the drill-bit, and must have been derived from the solution formed by the action of the drill-water upon the moist rock. On another occasion a candle lowered into a drill-hole burned brightly in the portion that was in the brown cap, but became extinguished near the bottom, which was in the gray ore. Even the rapidly reciprocal movement of the bailer did not mix the gas and air sufficiently to change the observed condition. No smell of sulphur gas was detected. It seems probable therefore that the oxygen of the air was being used in changing ferrous into ferric sulphate. A third observation indicated the formation of copper carbonates where water charged with carbon di-oxide came in contact with copper sulphate, such carbon di-oxide being produced by the decay of organic matter on the brush-covered mountain during the change of seasons. Every spring the snow-water carries the copper leached from the cap into the narrow subsidiary gulches. In one of these, the Apex Yard gulch, where the descending water percolates through old filling or waste, containing remnants of ore, it can be seen precipitating its red metallic copper upon scrap-iron at the rate of 15 pounds of metal per 1000 gallons of water.

By similar chemical reactions the copper leached in the zone of weathering was carried downward by the ground-water into the porous and fractured monzonite, there to be precipitated on the chalcopyrite, pyrite, and probably bornite, coating and replacing these primary minerals with covellite and chalcocite, the higher sulphides of copper.

The deposit is called a 'porphyry' orebody because the copper has impregnated an igneous rock having the porphyritic or speckled habit; it is also called a 'disseminated' copper deposit because the metal is distributed comparatively uniformly in minute particles throughout the mass; but to the geologist the Utah Copper orebody is an example of concentration rather than scattering; nature has brought together the copper from two sources, adding that which originated from below to that which was derived at a later stage from above. The net result has been to produce a mountainous mass of a billion tons of rock containing 1% copper per ton,[8] out of which the miner will select as much as it is profitable to exploit, such selection being determined by the cheapness with which he can break, transport, and treat the ore, and then refine the resultant metal. The operations of nature, mechanical and chemical, are supplemented by those of man, who is a great mimic, to the end that, among other things, the metal needed for munitions of war, for the conduction of electric energy, and for the transmission of speech may be available to that complicated system of life we call civilization.

The accompanying map shows the position of the Utah Copper mine in relation to the geologic structure of the locality. Most of the orebody coincides with a peninsular exposure of monzonite, but it also includes portions of the quartzite surrounding the monzonite. This rock extends eastward into the ground of the Ohio Copper, southwestward into the Newhaven and Utah Consolidated (Highland Boy), and south-eastward into the Niagara mine of the United States Smelting, Refining & Mining Co.; but it has not proved ore-bearing anywhere outside the Utah Copper property except in the Ohio Copper company's ground, where, however, the ore now being won comes entirely from the quartzite adjoining the monzonite. See Fig. 1.

THE WORKINGS. Let us now visit the mine itself—the theatre-like quarry that I have tried to describe in a general way. Mr. Carnahan was my guide and to him I owe most of my information. At the base of the tiers of levels, averaging 69.5 ft. apart in vertical height, is the 'Sub A' pit, the bottom of which is at an altitude of 6249 ft. above the sea. A green pool of water on the floor of this pit suggests copper, but fails to indicate that an adit, called the Mascotte tunnel, 12,000 ft. long, conducts the drainage under the opposite ridge (on which we stood to get our view of the mine), into the Salt Lake valley on the other side. See Fig. 1. This adit serves as a motor-haulage level from the Ohio Copper mine to the concentrating-mill at Lark. The 'Sub A' pit, which forms the lowest level of the Utah Copper surface workings, is 681 ft. above this adit and drains into it as follows: a 6-inch churn-drill hole, 60 ft. long, connects the bottom of the pit with a drainage-drift, which, in turn,

[6]Op. cit. pp. 299, 390, 394.

[7]Mr. Beeson says 20 ft., but that is probably an error.

[8]This is merely my own generalized statement, of geologic interest; the estimate of ore in the mine is given in the annual report and is quoted elsewhere.

connects with the main shaft of the Ohio mine and through it with the Mascotte adit. From the 'Sub A' pit to the top of the mountain the vertical distance was 1600 ft., but now that the crest has been removed the total height is 7700 ft. above sea-level. The lowest working in use is the 'A' pit, which is 105 ft. above the 'Sub A'. When we began our walk, a steam-shovel in the pit was puffing lustily as it loaded a train of five cars, each shovel, or 'dipper', transferring 7 tons from the pile of ore that had accumulated at the foot of the slope. The

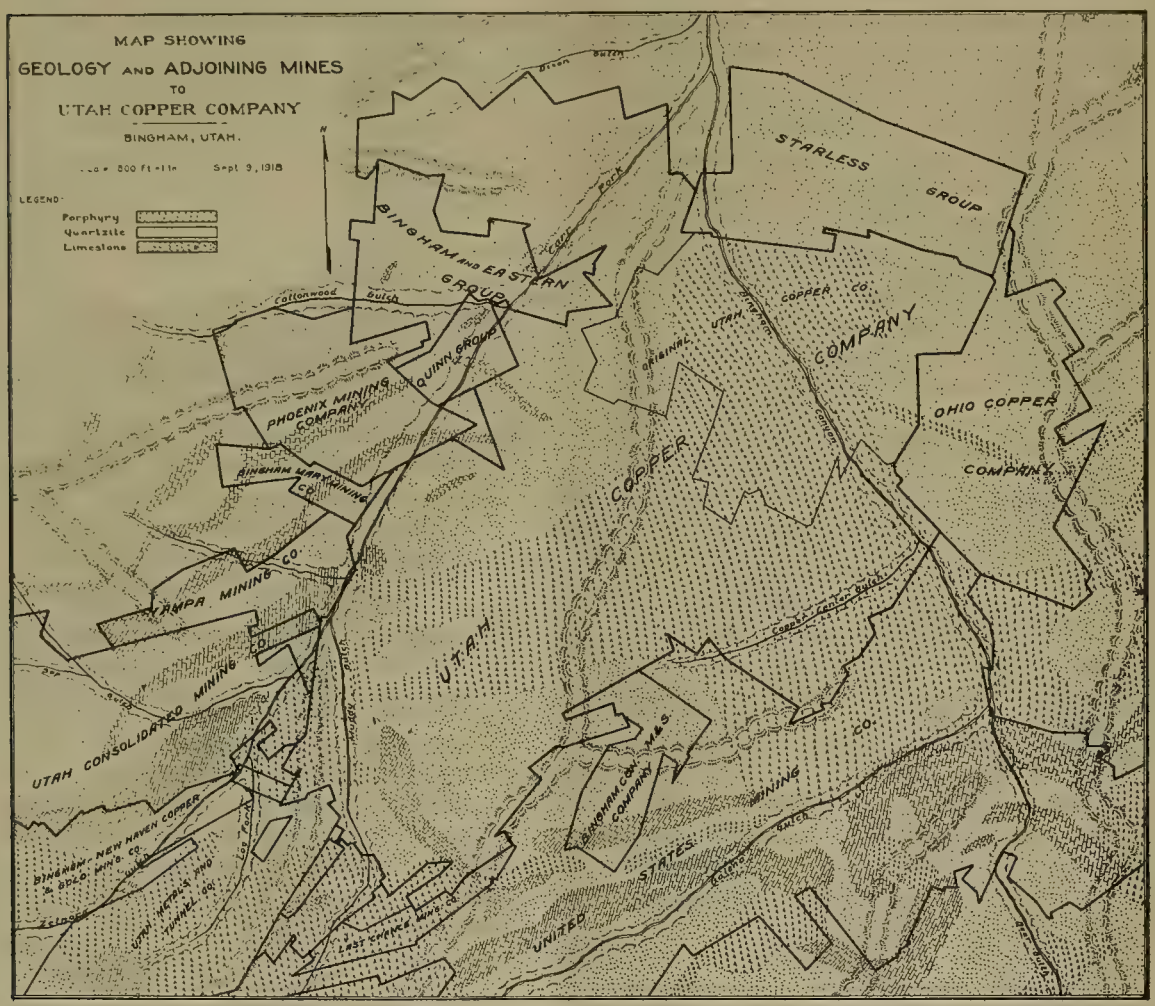


FIG. 2. GEOLOGY OF BINGHAM, AFTER U. S. GEOLOGICAL SURVEY, BUT REVISED AND CORRECTED TO DATE

main, or F, level is 240 ft. higher. On the face of ore—a cliff of gray rock—one could see men, like black ants, so small they seemed in contrast to the size of the excavations. These 'bank-men' were 'barring down' loose ore so that it might descend and accumulate like an artificial talus on the floor of the pit ready for the steam-shovel. Like cats they clung to the precipitous face, holding to a rope suspended from above. The banks slope at an average angle of 50°. The terraces are from 40 to 250 ft. wide, averaging 100 ft. in width. These 'bank-men' are Italians, probably from the Val D'Aosta, mountaineers and smugglers such as I used to employ when manager of the Grand Clos silver-lead mine on the French-Italian border near Briançon in 1891. I noted a man pouring water from a barrel into a pipe leading to the drillers below, on the face of the cliff. Walking along the F level, we came to a group of men engaged in drilling. The crew consisted of a machine-man with two helpers. The drill was an Ingersoll 3½-in. machine, known as F 24. The holes are made 30 ft. deep in the floor of the terrace, and not quite as long—28 ft.—in the face. When starting, a box is put around the collar of the hole, in order to exclude loose bits of rock; this is covered with a scrap of paper (no part of a treaty) from the dynamite-box and kept in place by a stone until the time comes to load the hole and blast it—which time arrives when ore is needed directly below, that is, when the steam-shovel moves to that part of the pit. The dynamite is Red H, No. 4; it is 80% ammonium nitrate and 10% nitro-glycerine, but it is marked 60% in order

to make the men careful. The explosive[9] is manufactured, as previously stated, at Bacchus, by the Hercules Powder Co. Black powder is no longer used; it was employed in the short drifts, or 'gophers', that were driven into the hill at the start as part of the system of 'bank-blasting'.[10] On the top level, however, it is still the custom to use black powder in the Keystone drill-holes. No. 3 Keystone machines are used to drill the bank on the two uppermost terraces. They have been found economical at these particular levels because the banks are relatively high and the terraces wide. During June 369,050 pounds of explosive was used in shifting 1,035,103 cubic yards of rock. The holes are chambered at the bottom so as to make room for the effective use of the maximum possible amount of dynamite at the bottom. The signal indicating that the hole is about to be 'sprung' is one long whistle followed by three short ones. The dust and gas shoot forth like a geyser. Two long whistles signify that the operation is finished. These signals, of course, are warnings to the men working in the immediate vicinity, particularly on the level below. All the way up the hill there are 'powder-men', who have to be informed before blasting of any kind can take place, in order to tell the workers when to move out of danger from flying stones. The man on the level above gives the warning and indicates the direction of safety. Three or four huts made of old railroad ties are distributed over each terrace, so as to afford shelter when a blast is in progress. Not many employees are hurt. A 'Safety First' campaign was organized several years ago, with the most beneficial results, and recently a 'safety engineer' has been appointed to supervise this department.

Looking at the nearest bank of ore, I noted that the general grayness was blotched with green where the copper sulphate, exuding by seepage, had dried. Toward the edges of the huge quarry the yellowish brown of the cap (oxidized monzonite and iron-stained quartzite) covered the gray ore-bearing rock. The best ore is a light-gray monzonite, the feldspar of which has been turned to sericite. At the south end is a darker and poorer monzonite, and to the north is the quartzite. The brown cap, with its copper carbonate, staining it in patches of green and blue, is broken independently, for separate treatment, as we shall see. Not much of the quartzite is ore. All that is not 'ore', and therefore 'waste', is removed into a neighboring gulch, so as not to interfere with the excavation of ore. As the eye ranges over the successive levels and envisages the scene, it is difficult to realize that 1800 men are at work, for only those near-by are visible. The younger Rockefeller (John D. Jr.), when here a year ago, said: "It is the greatest industrial spectacle in the world"—and he ought to know.

The hill, now cut and scarred beyond the recognition of the pioneers, is honeycombed with 60 miles of underground workings, which were made chiefly to explore the orebody and to ascertain its dimensions. See Fig. 1. This work was done between 1900 and 1915. For three years, from April 1904 to June 1907, all the ore that was milled came from underground stoping and development, but subsequently, as the stripping of the hill advanced sufficiently to permit of systematic open-air mining, a steadily increasing proportion of ore has come from the steam-shoveling operations, until in March 1914 no more ore was broken underground. Fully 6,250,000 tons of ore has been derived from the underground workings, besides 1,518,691[11] tons mined by the Boston Consolidated company before its mine was merged with the Utah Copper. The east hill opposite likewise has 27 miles of subterranean excavations, riddling the monzonite and quartzite, but it still retains its cover of grass and brush, amid which copper-stained croppings can be seen similar to those that incited intelligent interest in the west hill, now completely stripped of its covering of verdure and soil. The earliest mining done by the Utah Copper company was on this eastern side of the canyon; a caving of the surface above old workings shows where the first ore was broken for milling at Copperton in 1904. At the foot of the hill, in the bottom of the canyon, was the little Rogers mill where D. C. Jackling made his mill-tests in 1899. Nothing remains of that 'historic' apparatus.

Each level, or terrace, has one line of pipe for compressed air and another for water. The steam-shovel track is laid in 5-ft. sections. Every time the shovel makes a cut, 20 to 25 ft. wide, the track and the two pipelines have to be shifted. The laborers are divided into 30 gangs, of 8 to 20 men. These gangs are not assigned to any particular level, but are shifted as required. The first gang that I saw consisted of Albanians. The steam-shovel moves on a track that is 25 ft. from the one on which are the cars to be loaded. A train of five cars receives the ore as it is dug and loaded by one steam-shovel operating a dipper having a capacity of 3½ cubic yards, equivalent to 7 tons of ore. Above the J level the larger engines are in use; each of these pulls 10 cars. The company uses 21 steam-shovels, of which 15 are Marion model 91, 2 Marion model 60, 2 Bucyrus 95-C, and 2 Atlantic 80. Watching a steam-shovel at work, I recalled similar operations that I saw in the North while

[9]In the monthly statement of 'Coal Mine Fatalities in the United States for March 1918,' the following description of Explosive Red H No. 4 is given: "Volume of poisonous gases produced per one and one-half pounds, more than 53 to 106 litres. It belongs to the ammonium nitrate class containing a sensitizer that is in itself an explosive. It is permissible only when fired with a detonator (preferably an electric detonator) of not less efficiency than No. 6. The average weight of 1¼ by 8-in. cartridges is 164 grammes. It is permissible in diameters of ⅞ in. or larger. The unit of deflective charge is 248 gm. The rate of detonation in 1¼-in. cartridges is 8980 ft. per sec. (2738 metres per second). It is manufactured by the Hercules Powder Company, Wilmington, Delaware."

[10]Courtenay De Kalb. 'The Utah Copper Mine.' M. & S. P., April 10, 1909. Page 518.

[11]Of which 1,072,921 was mined in the monzonite and 445,770 tons was heavy sulphide ore mined in the limestone and shipped direct to the smelters; most of it being copper ore and the remainder lead ore.

the Yukon ditch was being dug in 1908.[12] The 'similarity' began and ended with the machine itself, for the ground and the result of the digging were strangely different. There the moss had to be stripped from the frozen ground before the steam-shovel, burning wood, could set to work. Labor cost $6 per day, including $2 for board, which seemed preposterously high then, but in these War days no longer warrants exclamatory remark. The difficulty of digging the Yukon ditch was not rock but ice, which is harder to conquer. All the steam-shovels at Bingham are covered with sheet-iron in order to protect the crew from flying stones. The machinery itself is protected by a housing consisting of 3-inch plank covered with ⅛-inch sheet-iron. The crew consists of one engineer, one crane-man, and one fireman—all Americans—besides a pit-crew of five men, usually Greeks, whose duty it is to lay the 5-ft. lengths of rail ahead of the shovel, loosen and tighten the jack-screws when the shovel is moved, and keep the loading-track clear of broken ore.

(To be Continued)

SHIPPING locked through the Sault Sainte Marie canals, both American and Canadian, during five months this season, included mineral tonnages as shown below:

	1918	1917
Eastbound:		
Copper	53,004	75,342
Iron ore	38,734,187	35,476,517
Westbound:		
Coal	9,222,706	9,125,329
Iron	24,438	63,698
Iron ore	74,928	38,005
Oil	209,266	.....
Salt, barrels	52,615	338,153

The total of all commerce in 1918, to August 31, is 50,400,698 tons, a gain of 492,198 tons. Ships numbering 12,390 passed through, a decrease of 731 vessels.

Traffic through the Suez canal, a sea-level waterway, totaled 2353 vessels and 8,368,918 tons during the whole of 1917. In 1913, a normal year, the tonnage was 58.23% greater. The toll charge is 24.1 cents per ton.

CAST-COPPER tuyeres and coolers for blast-furnaces offer advantages over the old type of cast-iron tuyere, according to A. K. Reese, in 'Engineering'. The greater first cost of the copper is more than offset by the greater economy in operation that can be obtained. Tuyeres of rolled, hammered, or pressed copper are even more desirable than those of cast-iron, being more homogeneous and more resistant to abrasion.

GANISTER used in Scotland successfully as a lining for retort-ovens in by-product coking, according to A. K. McCosh, has the following composition: SiO_2 80.8%, $Al_2O_3 + Fe_2O_3$ 17.8%, CaO 0.8%, and MgO 0.07%. The bricks made of this material are highly resistant when the gas is carefully regulated, and such lining will last from seven to ten years.

[12] 'Through the Yukon and Alaska', by T. A. Rickard. Pp. 239-248.

Potash From Cement

In potash recovery the field of application that has been developed furthest is in connection with cement-kiln gases. Several plants are now in successful operation, and a considerable tonnage of potash is being obtained. Other plants are under construction, and the outlook for a large increase is favorable. In the issue of the 'American Fertilizer' of August 31, 1918, John J. Porter, general manager for the Security Cement & Lime Co., of Hagerstown, Maryland, gives much valuable information. He says, regarding the estimation of potash recovery or for the benefit of those who may wish to figure on their own conditions:

"I give the following method of calculating the probable recovery of potash:

Let A = per cent potash in raw mix.

B = per cent potash in clinker.

C = per cent liberation = $\frac{600A - 380B}{600A}$

F = pounds of potash recombined per barrel of clinker = 0.7 to 1.5, depending on fuel consumption and per cent of ash in coal.

P = per cent potash precipitated in treaters.

Assume 600 lb. of raw mix actually used to make 1 barrel of clinker.

Then—Pounds of potash entering kilns per barrel of clinker = 600 A.

Pounds of potash volatilized in kilns per barrel of clinker = 600 AC.

Pounds of water-soluble potash entering treaters per barrel of clinker = 600 AC-F.

Pounds of water-soluble potash collected in treaters per barrel of clinker = (600 AC-F) XP.

The cost of collecting potash at Security is now about as follows:

	Per unit of potash, cents
Collection, including labor, power, repairs, and laboratory	14
Packing and shipping	8
Total operating cost, exclusive of depreciation, royalty, and salt addition	22

The cost of the salt addition is about 25c. per unit of potash, but this is not a necessary element of the cost, and can be omitted whenever the conditions affecting the price become such as to give an unsatisfactory margin of profits."

The article shows that from a 3000-bbl. cement plant the operating profit per annum on the potash alone is about $458,000, the raw mix containing 0.75% of potash. The article is replete in details.—Linn Bradley in 'Manufacturers Record.'

WHITE ZINC SULPHIDE has not been imported during the year in quantities as large as formerly. The price of the precipitated ZnS during the last quarter averaged 31c. per lb. The use of this substance will be greatly extended when it is made available at lower figures.

Inflation and Business After the War

*The effects of inflation have been visible for some time in wages and the prices of commodities, but not in the prices of securities or of real estate. This fact is the subject of much inquiry and comment. If inflation is a factor of general import, as it is supposed to be, affecting the purchasing power of money, why doesn't it show in the prices of bonds and stocks and of real estate? What is modifying or retarding its influence in these quarters, and will its effects appear in these prices later?

As the first step toward any discussion of inflation it is necessary to have an understanding of the term. Some persons apply it only to an undue expansion of paper currency, but an expansion of bank loans and deposits has the same effect, since checks are now the common medium of payments. Others in referring to inflation have in mind a general state of abnormally high prices incidental to great industrial activity, whatever the primary cause may have been. Many people argue that the inflation of credits at this time is wholly the result of the war-demands, but they take no account of the part played by an increased supply of credit or money in facilitating the demands. In time of peace a country's industries are occupied in supplying its consumptive wants and in construction work to enlarge its powers of production. If, when a country goes to war, it would curtail these accustomed demands enough to offset the new war-demands, there would be no rise of prices. But people do not curtail their accustomed demands to any such extent. They go on trying to buy and consume as usual, and since there is not labor enough to do everything, employers raise wages to get labor away from each other, and all prices and costs rise. More credit is required to handle all business under these conditions, but whatever amount of credit is supplied is quickly absorbed, because the bidding for labor and materials continues. In short, each new supply of credit finances a further rise of prices, because costs and prices follow each other around a circle.

It is this relation of credit to price inflation that we are now discussing. The prevalent idea seems to be that since an undue expansion of the medium of exchange has the effect of diluting and depreciating it, the depreciation should be the same in relation to all kinds of property. This is not the effect, for the simple reason that there is not an equal demand for all kinds of property. In other words, the depreciation of the currency, or purchasing agency, does not occur simply as a result of increasing quantity, but from increasing competitive efforts to exchange it for something else. If there was no attempt to use enlarged purchasing facilities there would be no effect upon prices. There is no abstract calculation or measurement of values, but an ordinary operation of the law of supply and demand. A greater relative supply of currency, accompanied by strenuous efforts to exchange it for certain things which are of immediate importance, causes the currency to lose purchasing power with relation to those things.

The primary cause of this great rise of wages and prices of course is the War. It has taken millions of men from the industries and set up an enormous demand for the war supplies.

After the War is over, there will be a change of all conditions. When the Government orders are finished and paid for, unless a similar volume of equally urgent demands spring up from new sources the inflation of credits will subside. Bank loans and deposits will decline and the percentage of bank reserves will rise. This would mean a readjustment of values toward the pre-war basis. Evidently the course of this readjustment will be governed by the industrial situation and prospects at that time. If the transition from war conditions to peace conditions is fortunately accomplished; if industry is well sustained and free from disorganizing controversies, so that both the investing and consuming power of the country is large, the establishment of a feeling of full confidence is likely to be followed by one of the greatest periods of construction and expansion the country has ever known. The future of wages, prices, and values in general will depend upon harmonious, highly-organized, efficient, well-balanced industry, creating new wealth at a rate sufficient to satisfy the growing wants of the people.

Will this state of inflation end with a collapse of credit after the War? It is safe to say that the credits which have been created for war purposes in this country will be generally liquidated at the end of the War without losses, because they rest at last upon the credit of the Government. When the Government purchases fall off and its contracts are liquidated, there will be a general liquidation of private indebtedness related to war work, and war work is now the chief factor in industry.

There has been no considerable expansion of credit outside of the war industries. Building operations and new construction of all kinds are at low ebb, except as related to the war industries; real estate is inactive, loans for the purchase of stocks and securities are lower than usual, and the prices of stocks, bonds, and real estate are below rather than above the normal level.

These are not the conditions under which panics occur from an over-extension and collapse of credit. It is evident, therefore, that although an abnormal expansion exists at this time the situation is different from that of a boom period, when credit is over-extended upon the basis of more or less speculative private enterprises, about which confidence may be eventually weakened. The statements of corporations generally show that their

*Bulletin, National City Bank, New York, October 1918.

financial condition has improved in the last three years. They have made only moderate distributions from earnings, have reduced their bonded indebtedness, and although current indebtedness is large, that should be covered by the orders in hand.

A tight rein is being held upon every tendency to use credit outside of essential purposes, and there is little temptation or opportunity to use it along venturesome lines. As a result there is less uncertainty about the credits of the country than in ordinary times, and there is no danger of anything like a general breakdown or panic while the present situation exists.

The danger of a credit collapse will come, not in the liquidation of the credits now outstanding, or of succeeding credits based upon war business, which practically have the credit of the Government behind them, but at the end of the boom period, if there should be one following the War, when credits will have nothing behind them but private enterprises and promises, and the whole situation is based upon an inflated and uncertain state of values.

We may expect that after the War there will be a waiting demand for many kinds of goods and equipment so urgent that for a time price will be a secondary consideration. The whole world is doing without things that it would gladly buy, wearing out equipment and falling behind its wants. It is falling behind in house-building, for example, in road-making, in railway extensions and in the development and improvement of public utilities. Automobile construction has nearly ceased, and the cars in use will be nearly worn out. Clothing will be worn out the world over, and stocks of cotton will be low, therefore there will be a good market for cotton and our cotton States should be prosperous. Not only is there the rebuilding and rehabilitation of the war-devastated districts to be done, but the development of the backward countries looms up with more definite and immediate promise than ever before. The world is not going to seem so large, or its divisions so separate and distinct from each other as in the past. Foreign countries will not appear so remote and difficult of access to Americans. Undeveloped resources, which will contribute to the comfort and welfare of mankind, will not be neglected anywhere if stable government and protection to investments can be had. The stir of the War will be in the blood of all nations and the impulse to do things will be manifest. These are the conditions favorable to a period of enterprise and activity, and which will tend to sustain prices or moderate their decline.

Nevertheless, it is inevitable that prices will be upon a declining scale and this will be the factor of uncertainty and danger in the situation. Falling prices, shrinking values in inventories, stocks of goods, and capital investments, have a depressing influence. It is comparatively easy to make money when prices are rising; the most venturesome may be the most successful then. Errors of judgment are made good by something outside the management. Farmers of even indifferent skill, who could make but a poor showing of profits from their farming operations, have become well-off from the rise of land values. The situation is very different with prices on a declining scale, for then not only is there no margin furnished gratuitously by an unearned difference between buying and selling prices, but a portion of the normal earnings is lost, and as net earnings decline, capital values shrink, credit is unfavorably affected, and indebtedness becomes relatively heavier and more burdensome. Therefore it is in order to give warning against incurring indebtedness, which will reach over into the period after the War, when prices and earnings will be lower than now.

There is another reason why prices must come down after the War, and that is that unless they do the monetary systems of the whole world will have to be re-organized in a manner which will not only do great injustice to all persons who hold a creditor position, but involve business affairs generally in such confusion as will disorganize production and the exchanges and occasion losses to all classes.

The monetary systems of the world almost without exception, are now based upon gold. The monetary units of nearly all countries are fixed in terms of gold, and since they all have a fixed relation to the grain of gold it follows that they have a definite relationship to each other. This is favorable to international commerce and financial relations. China has been the only important country whose currency was not related to the gold standard, but its government has taken steps within the last month for establishing such relationship. The great service of this common unit of value in world affairs is illustrated and emphasized at the present time by the difficulties which arise because temporarily the free movements of gold are interrupted.

But the present rise of prices has destroyed the normal relationship between gold and other commodities. Gold is priced in terms of itself; an ounce of it will bring $20.67 at the United States mint, because at the coinage rate an ounce will make that amount of money. There is no magic about the act of coinage. The word 'dollar' is simply the name given to 25.8 grains of gold nine-tenths fine. The Government does not attempt to determine the exchange value of the 'dollar'; that depends on the law of supply and demand, and unfortunately for the gold producers there are other ways of producing dollars than by digging gold, and just now there is a great output of 'credit' dollars. Since there are restrictions upon the disposition of gold outside of the mint, he can get no more than the mint price, and the cost of mining gold has risen until mines of low grade are working at a loss or closing down, thus reducing the new supplies.

The production of gold cannot be maintained at its present valuation in relation to other commodities. That is to say, with labor, coal, machinery, chemicals, and other supplies necessary to its production at present prices, gold cannot be produced at a profit to be coined at $20.67 per ounce.

While the War goes on, credit will be artificially elastic in order that the necessities of the Government may be met, and the risk of credit expansion is minimized, as

stated above, by the fact that Government credit is so largely behind the situation; but when the War ends this reduction in the output of gold is bound to make itself felt in the credit situation. The normal additions to banking reserves will not be made, and credits will be correspondingly restricted, with the result that prices will decline. The influence is the reverse of that which has been seen from rapidly increasing bank reserves.

In short, the level of prices has a definite relation to the standard of value. Following the discovery of the South African goldfield, and of the cyanide method of treating ores, the world's production of gold increased rapidly, and a period of what was called 'gold inflation' and rising prices ensued, lasting down to the outbreak of the War, although the rate of production was practically at a standstill for several years before the War. The amount of bank credit available before the War was related to the bank reserves, and the level of prices the world over was adjusted to this relationship. It is possible, temporarily, by the use of Government credit, to sustain a higher level of prices without a corresponding increase of gold reserves, but it cannot be done permanently. The circulating credit must be freely convertible into the standard of value, if prices are to have any definite relation to the standard, or if prices in different countries are to have any definite relation to each other.

In short the prices of other things must come down in relation to gold if gold is to remain the standard of value. Under the present relationship gold production will stop, and bank reserves will be at a standstill until prices fall sufficiently to allow gold production to be resumed.

Professor Irving Fisher has proposed a new feature for the commodity standard. His proposal is that we continue to base our currency upon gold, but that the amount of gold represented by the paper dollar be changed from time to time in order to maintain a substantially fixed relation between the 'dollar' and the value of commodities. In other words, the 'dollar' would be 'corrected' from time to time to conform to prices, and to keep the average of commodity prices at a uniform level. By this means the gold dollar would be a compensating balance for the commodity unit. If the list of commodities adopted as the standard showed a tendency to rise, on the average of them all, it would be taken as a sign that gold was becoming cheaper, and this would be corrected by putting a little more gold in the dollar. If, on the other hand, prices showed a tendency to fall, this would be accepted as proof that gold was becoming dearer, and a grain or fraction thereof would be deducted from the dollar.

It will be seen that Professor Fisher's object is to stabilize prices and relate the currency and all credit instruments definitely to the prices of commodities, something in itself undoubtedly to be desired. If this system had been in force when prices began to rise, in 1915, instead of a reduction in the gold content of the dollar, or a bonus for gold mining to offset the rising costs, or any other action calculated to maintain gold production, the miners would have been promptly required to give an increased amount of gold for a dollar, and the required amount would have been increased as fast and as long as commodity prices advanced, not only to the extent of closing down the mines, but to the extent of melting down our existing gold coins to make them represent a smaller number of dollars. In other words, the system would continue to put more gold into the dollar, until the point was reached where prices in terms of gold stopped rising.

Nobody claims that gold is an ideally perfect standard of value, or that fluctuations in prices which are due to fluctuations in the production of gold are not to be regretted. One by one, however, the countries have come to the gold standard, because it has greater advantages, stability included, than any other standard of value ever in use. It has the one great advantage over any theoretical system in its simplicity, and another great advantage in the fact that all the world has adopted it. The primary purpose of a standard is to provide a common basis on which to do business, and the business world is slow to listen to proposals which it does not readily understand, and which it is very sure other countries, for the same reason, will not readily adopt. Granted that it is very desirable to have the whole business world thinking in common terms, and you once have that accomplished, no section of it is likely to be receptive to the idea of adopting a new language of values for itself.

Completed Figures for Gold and Silver Output, 1917

During the calendar year 1917, the United States mined 4,051,440 oz. of gold, valued at $83,750,440, and 71,740,362 oz. of silver, valued at $59,078,100, according to a report compiled by the Bureau of the Mint and the Geological Survey, made public on October 1. The volume of the silver mined during 1917 was estimated on the average of the New York dealer's buying-price during that period of 82.35c. per ounce. The price in 1916 was 65.66c.; 49.68c. in 1915; 54.81c. in 1914; 59.79c. in 1913; 60.83c. in 1912; 53.30c. in 1911, and 53.49c. in 1910.

In 1916 the gold output was worth $92,590,300, and 74,414,802 oz. of silver extracted, a reduction in the gold output of $8,839,600 and 2,674,440 fine ounces in silver production. In the calendar year of 1917, California led the whole of the United States in gold production, by turning out 1,012,461 oz., to the value of $20,929,400. Alaska was second with 709,729 oz., valued at $14,671,400; Nevada next with 335,361 oz., valued at $6,932,500; South Dakota, 356,662 oz., at a value of $7,372,900, an increase of 250,613 oz., valued at $1,180,600, the remainder of the States contributing smaller amounts to the total.

In silver production, Montana led all others with 14,555,034 oz., valued at $11,986,100. Other States producing large quantities of silver during 1917 were Idaho, with 11,402,542 oz., with a value of $9,390,000; Nevada, 11,217,654, valued at $9,237,700; Utah, 13,360,905, valued at $11,022,000; Colorado, 7,291,495, valued at $6,004,500; and Arizona, 6,962,257 oz., valued at $5,733,400.

THE CLIMAX MOLYBDENUM COMPANY'S MILL

Recent Developments in Molybdenum

By L. F. S. HOLLAND

It is reasonably expected that since a steady source of supply of molybdenum now is assured, the manufacturers of alloys will be encouraged to use this valuable metal in greater amounts than heretofore. Temporarily, the quantity of molybdenum ore and concentrates offered may exceed the demand, and there may be a still further drop in the price, which is about $1 as compared with the price a few weeks ago when these materials were selling in the Eastern market for $2.20 per pound of contained molybdenum sulphide. Ultimately, the market should show more stability, and it is hoped by the operators of molybdenite properties that the price will be at least as high as the British government's price during the War, namely, five guineas per unit, or about $1.25 per pound.

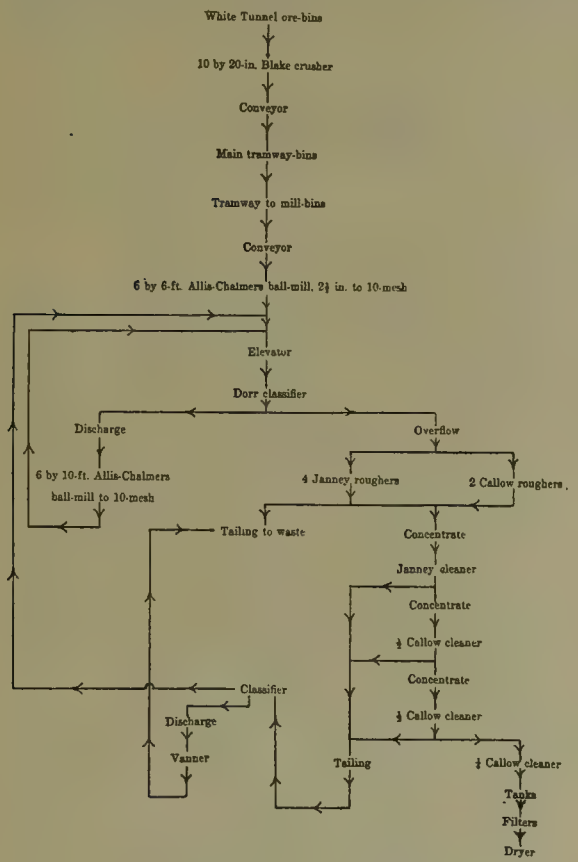
The outlook for wulfenite (molybdate of lead) concentrates in the near future is more doubtful, as there is no encouragement to consumers to use the limited capacity of their plants in treating wulfenite, or slag from wulfenite, comparatively low in molybdenum, even if the lead contained costs them nothing, when plenty of molybdenite much higher in molybdenum is available. However, it is hoped that such mines as the Mammoth-Collins in Arizona, which might supply a large quantity of wulfenite concentrate if there were a better market, may be benefited ultimately by a greater use of molybdenum.

The development of the property of the Climax Molybdenum Co., at Climax, Summit county, Colorado, has set a new standard of comparison for molybdenite mines in the United States. Instead of the common type of rather small deposit, operated precariously as an irregular market for molybdenum products may allow, the Climax has several million tons of commercial ore developed, and an excellent mill already treating about 250 tons per day, which is to be enlarged in the near future as the demand for molybdenite increases. The Climax mine is on Bartlett mountain, on the Continental Divide, about 15 miles north-east of Leadville, Colorado. The elevation of Climax station, on a narrow-gauge branch of the Colorado & Southern railroad, close to which is the mill, is 11,303 ft. above the sea. The mine is about a mile farther east, and the two principal tunnels are at an elevation of about 12,100 and 11,900 ft., respectively. Operating conditions in this mountainous country are difficult, owing to large amounts of snow during the greater part of the year. However, the mill, the wire-rope tramway between the mine and the mill, and several buildings, were erected during the past winter. The operators deserve great credit for accomplishing so much in so short a time, and under such trying climatic conditions. The purchase of the property, development, and erection of plant, have called for an expenditure of about $600,000. The molybdenite orebodies occur in two hills of alaskite-granite, north-west and south-east of the gulch. Only the north-west hill has so far been developed to any extent. The developed mine is on the original five claims, each 150 by 1500 ft., on the north-west hill. The Molybdenum Products Co. also has one developed claim, 150 by 1500 ft., on the north-west hill. Various parties, including the Climax company, have claims on the south-east hill.

The alaskite-granite has intruded an older gneiss, and a large zone in the alaskite-granite has been fractured and further silicified. Chunks of the gneiss are occasionally included in the alaskite-granite. Areas of quartz-porphyry containing little or no mineral also appear. The molybdenite occurs in a finely disseminated form in the quartzose masses and veinlets in the silicified zone. A typical piece of ore, shown in the illustration,

reveals criss-cross veinlets with fine-grained molybdenite, like pencil lines. It resembles some of the disseminated copper ores at Bingham, Utah, and at Burro mountain, New Mexico. The molybdenite, however, is primary, and was apparently deposited with the silicious material by magmatic segregation from the cooling and solidifying mass of alaskite-granite. The obviously pegmatitic bodies, commonly associated with molybdenite deposits, are not here in evidence. Some pyrite, and a little chalcopyrite, are found. No coarse or flaky molybdenite in cleavage and fracture planes is observed in the Climax deposit. Molybdite, the yellow oxide, appears in considerable amount, however, where oxidation has been favorable through the agency of circulating waters.

The part of the Climax company's orebody completely



FLOW-SHEET OF CLIMAX MILL

developed measures about 800 by 800 ft., with 'backs' said to average about 250 ft. Additional development work from the lower tunnel is expected to increase the ore-reserves considerably. The alaskite-granite area, part of which is ore-bearing, is limited by its east-west and north-south contacts with the gneiss. In the lower tunnel an east-west contact dips about 70° to the southeast. A contact also shows in a well south of the railroad track. The orebody is developed by parallel drifts 25 ft. apart, 800 ft. long. It is intended to carry shrinkage-stopes to the surface from these drifts and afterward break down the intermediate pillars. It is possible that ore may be broken from the surface into 'glory holes', but the excessive amount of snow at this elevation would be troublesome. Six stoper-drills and four piston-drills take care of the stoping and development work. As the result of a certain amount of selective mining, the ore sent to the mill is said to have assayed about 0.8 to 1% molybdenum sulphide, of which an appreciable proportion should be reported in terms of molybdic acid on account of the molybdite content. To estimate the average mineral content of so large an orebody, it may be a case of having to eat one's cake to find exactly of what it is composed. From the inspection of a large number of molybdenite deposits, I would guess that the average assay of the Climax ore would be about 0.6%, but molybdenite ores are often deceitful in appearance. The official estimate of 1% of molybdenum sulphide is doubtless based on systematic sampling.

In the milling of such an ore by table-concentration and flotation, the molybdite (yellow oxide) is practically all lost. It may be saved, if in sufficient quantity to be worth while, by solution in a cheap special alkali, by a patented process. It may be noted that the flotation of the Climax ore is performed in an alkaline solution.

The concentration ratio is 1:125. The extraction is said to be about 70%, or about 11 lb. molybdenum sulphide to the ton, in a concentrate assaying about 65% molybdenum sulphide. The endeavor is to keep the pyrite content in the concentrate under 9%. There is practically no chalcopyrite to contend with. The mining costs are understood to be approximately 70c. per ton and the milling costs about the same. It may be possible, perhaps, to produce concentrate at an operating cost of 40c. per pound of molybdenum sulphide.

The accompanying flow-sheet has been adopted in the mill.

In common with most mines in the West, Climax is suffering from a shortage of skilled labor, and this is likely to become increasingly acute until such time as the civilized world has accomplished its most important duty of thoroughly beating the Hun. Meantime the American Metal Co.'s interest in the Climax Molybdenum Co. will be taken care of by A. Mitchell Palmer, as administrator of enemy alien property. The Climax Molybdenum Co. is fortunate in having an able and efficient technical staff. As might be expected with men of this character in charge of operations, the air of mystery and secrecy which so often pervades small rare-metal plants is conspicuous by its absence. For many courtesies, I am indebted to Harry L. Brown, chief of the mining department of the American Metal Co., to O. R. Whitaker, consulting engineer, Webster P. Cary, superintendent, and James R. Welch, mine superintendent. John H. White, the manager, was absent at the time of my visit.

The Molybdenum Products Co.'s mine is included in one narrow claim, but, though much smaller than the Climax Molybdenum Co.'s mine, it has considerable ore-reserves. It has a 600-ft. tunnel, with laterals 150 ft. long and 50 ft. apart. Stopes are carried 12 ft. wide with

ore-chutes about 12 ft. apart. The Molybdenum Products Co.'s mill is not open for inspection, but is understood to consist of three Telsmith crushers, breaking the ore by stages down to one-quarter inch mesh; two 64½ Marcy ball-mills, grinding to minus 50-mesh; a Dorr simplex classifier, to be replaced by a duplex; four Deister tables; a four-cell K & K flotation machine, working with an alkaline solution and pine oil; and a cleaner of local construction, somewhat like the Callow apparatus. A light froth is desirable with the Climax ores. It appears to be the intention of the Molybdenum Products Co. to make a high-grade concentrate, assaying 90 to 95% molybdenum sulphide. M. S. MacCarthy is in charge of the company's operations, and Morgan Williams is mine superintendent.

POLISHED SPECIMEN OF CLIMAX MOLYBDENUM ORE

The published technical literature on the metallurgy of molybdenum is apt to be sketchy, and is not always reliable. There is room for much pioneer work in the investigation of the properties of alloys of molybdenum. Henry Ford's organization has accomplished something in this direction and is notable for installing a Greaves-Etchell's electric furnace to help in the investigations. The Metals Reduction Co. is making ferro-molybdenum at Washington, Pennsylvania, and it is understood that the Acme Steel Co. will shortly begin the production of molybdenum steel at a site acquired for that purpose at Glassmere, Pennsylvania. It is, of course, well known that molybdenum imparts properties to tool-steel similar to those given by tungsten. It is less well known that very small percentages of molybdenum, with or without copper, give steel an enormous tensile strength. The use of such small percentages on a large scale would considerably increase the consumption and demand for molybdenum. Sooner or later it will come into its own.

FELDSPAR disintegrated and mixed with carbon and sufficient lime to produce a readily fusible slag and heated to a high temperature in an electric furnace, results in part of the alkali of the feldspar being reduced and combining with carbon and nitrogen to form KCN, which, with other gases formed, escapes from the furnace and is collected. The Al_2O_3 and SiO_2 contained in the feldspar form slag with the lime, which is tapped off. Other alkali-metal silicate-bearing materials, such as mica or alum-slate, may be used, and if alum-slate is employed the hydrocarbons that it contains take the place of part of the carbon otherwise needed. The impurities which the raw materials contain cause the formation of various compounds other than cyanide, for example, cyanates may be formed. The electric furnace may be of the type shown in U. S. patent No. 1,186,921. The above method is covered by patent No. 1,264,949, issued to A. R. Lindblad.

CAUSTIC SODA is quoted at 3⅜ to 3½c. per lb. for 1919 delivery. Ground and powdered caustic is now selling in the open market at 5 to 5½c., with flake 76% firmly held at 6 to 6½ cents.

A Letter From the Front

We went over the top this time and sure gave the Huns hell. This division was the first over the top in the first great American and Allied offensive; this regiment was first to go and my company was the first over as the second battalion of the 23rd was the attacking party. We drove the Huns back eight miles in less than three hours and captured much of their artillery, a great many machine-guns, some aeroplanes, anti-aircraft guns, heavy artillery, a great many prisoners, including a General and his staff, and many other high German officers. A man in this company captured the General and two colonels. We took a few towns and in three hours did what they expected would take us two days. We went over again the next day and drove them back about six miles more.

It was the greatest battle I have seen so far. The Huns were taken by surprise. We were taken off one front and rode all day in trucks and hiked all night and did not even get a breathing spell before we started over the top. It was very still on the front, only a shell landing every few minutes till two of our guns spoke out at 4:45 a.m., which was the signal for the artillery; then such a noise! It was like the rumble of a thousand great rolls of thunder, and kept up all the time we were on the front and is still going. I brought in twelve prisoners and three were killed and one wounded when we were re-crossing the German fire. I did not get a scratch. I thought I was doing well, but some fellows brought in as many as four hundred. We did not lose very many. Most of the losses were slight wounds in legs, arms, and head, from machine-gun fire and shrapnel.

Just got through eating. We had mashed spuds, roast beef, gravy, white bread, and coffee. We get just as good most all the time, but there have been times when we got nothing and could not even get water. I have had the experience of dying for a drink of water and never knew before what it was like to go without water until my tongue felt like a piece of leather, my throat was burning up and my lips were cracked. I went all over the battle-field looking for canteens, but they were all empty. I picked up two Hun canteens, so when I did find water I filled up the two besides my own and had enough to last a few days, but it did not last more than two hours as there were lots of men coming back wounded who needed it more than I, so I had the thirst craze all over again, but not as bad as the first time. I will tell you my own story. We left the town in trucks at night. The one I was in got stuck in the mud and we worked all night getting it out. We were five hours behind the rest of the company and had to hike eight miles to where they were. They had five hours sleep, besides the time it took us to hike the eight miles. We got some hard tack and a cup of coffee and were just in time to start out with the rest.

We hiked ten miles more to the front and were just in position when our artillery opened up. I was in the second row so had to lay on my stomach until the first got started. There were two killed and two wounded within ten feet of me. The shells were breaking thick everywhere around us. The air was a steady screech of shrapnel and bullets. We got the order to move forward and started out. The shells were coming faster now and many more big ones. We advanced in the open through a wheat-field and plunged into some machine-guns. We had to do a tight-rope stunt across the Hun line, but most of us got across, when a great many Huns came out to surrender. Twelve came out in front of us and as I was the first man the Captain saw he gave me orders to take them back. So back I had to go with that wild twelve, who all wanted to go in different directions. I made them hold their hands over their heads and succeeded in getting them in although three were killed and one wounded before I got them to safety. I had to take them to Division Headquarters, way back 18 miles again, turned my prisoners over to the officer in charge and went back, but could not find my company, as they had gone so far ahead, so I joined an officer who had about twenty more who were also lost.

We were passing through a town that was being shelled. We got just outside the town and were told to wait beside a bank, which gave us some shelter from the shrapnel. We remained there for two hours and were not told to move, so we, the other fellow and I, started out and found the officer had gone and two of the men had been killed and four wounded. The rest had disappeared somewhere, and as the shells were falling fast and we were in no safe place we went for a big barn that was near-by. It happened to be a dressing-station. The officer in charge was short of men, so with four German Red Cross men we made stretchers out of two poles and a blanket and worked until we were relieved, which was two days later.

I am in the best of health and have had a good two days rest and expect to start on a two days hike tomorrow, where we will get rest for an extended time before going to the front again. Robert is not here yet but I am in hopes he will be soon as some fellows who were in the same place came back yesterday and said he would be here in a day or two. He did not miss anything but about a hundred million pieces of shot the same as the rest of us lucky ones.

The Huns lost a great many men. One Hun officer that was captured said there were only 18 left in the regiment he belonged to. They left everything in a hurry in their retreat. We found cans of hot coffee and new hot bread just baked. There was a bugler from this regiment who started in with three prisoners. He trusted them and treated them like human beings, which they were not. One took advantage and when he wasn't looking stuck him with a knife, making a fatal wound. But he shot the whole three before he died. So you see all the things we used to read in the papers were not lies, but the truth. A sergeant in this company was going to take an officer prisoner; the Hun officer started to draw a pistol from under his coat, but the sergeant beat him to it and got his gun out first and shot the Hun through the neck and when a 45 goes off at close range it is no joke; it just blew the Hun's head clean off his shoulders.

The Terry Differential Flotation Process

By JOSEPH T. TERRY, JR.

This process, protected by U. S. Patent No. 1254173, of January 22, 1918, and Canadian Patent No. 184193, of May 7, 1918, is based upon the discovery that ammonia in solution promotes oxidation of metallic sulphides by air introduced into the pulp.

An experiment illustrating the oxidizing influence of ammonia may be made by wetting clean pieces of iron with water, and with ammonia hydroxide. Yellow ferrous carbonate soon forms on the iron wetted with water, while the piece of iron wetted with ammonia hydroxide becomes bright red with ferric hydroxide.

As the oxides of zinc, copper, and lead are soluble in ammonia hydroxide and most ammonia salts, these sulphides are cleansed and their floatability unimpaired, whereas iron oxide is insoluble and the oxide filmed sulphides (pyrite or pyrrhotite) are rendered immune to flotation.

As air drives ammonia out of a solution, a closed tank with a circulating system is the most economical in which to carry on the oxidizing reaction and conserve the volatile ammonia gas. The amount of ammonia required to accomplish this result depends on the character of the ore, pulp-dilution or density, time of contact and aeration. Solutions containing from 0.04 to 0.06% NH_3 were used in the tests recorded in the accompanying data.

Ammonia hydroxide or ammonia gas may be introduced directly into the pulp or generated in situ by decomposition of ammonia salts by alkalies, for example, ammonium sulphate and sodium carbonate.

In treating some complex ores containing zinc, copper, lead, and iron sulphides by this process, ammonia may be introduced with the frothing-agent in the form of an emulsion and good results obtained. With other ores this procedure fails to make a high recovery and it is necessary to give the ore-pulp a preliminary treatment with ammonia and air before introducing the frothing-agent.

In the differential flotation of some zinc-copper-iron sulphide ores, it was found necessary to substantially remove the ammoniacal solution by decantation and replace

RESULTS OBTAINED BY THE TERRY DIFFERENTIAL PROCESS

								Total metals				
	Weight	Zn	Pb	Fe	Cu	CaO	SiO_2	Zn	Pb	Fe	Cu	CaO	SiO_2
Sample No. 1—100-mesh	%	%	%	%	%	%	%	%	%	%	%	%	%
Concentrate	21.6	49.20	nil	11.71	0.85	1.10	1.15	85.30	nil	18.00	93.95	3.28	1.03
Middling	15.2	10.10	....	12.92	0.05	11.20	24.18	12.29	....	13.97	7.05	23.51	11.33
Tailing	63.2	0.47	....	15.15	nil	8.40	44.90	2.41	....	68.03	....	73.21	87.64
Heading	100.0	12.44	....	14.05	0.20	7.23	32.37	100.00	....	100.00	100.00	100.00	100.00
Sample No. 2—100-mesh													
Concentrate	45.2	50.20	nil	12.63	trace	0.33	1.52	91.71	....	21.20	....	39.41	10.44
Middling	11.6	12.00	....	34.31	....	0.75	8.00	5.61	....	14.78	....	23.01	14.10
Tailing	43.2	1.55	....	39.85	....	0.33	11.50	2.68	....	64.02	....	37.58	75.46
Heading	100.0	23.70	....	25.94	....	0.48	6.70	100.00	....	100.00	....	100.00	100.00
Sample No. 3—100-mesh													
Concentrate	55.2	49.80	....	11.98	nil	0.40	0.41	96.08	....	26.17	....	45.00	15.60
Middling added to tailing													
Tailing	44.8	2.27	....	41.65	....	0.62	2.76	3.92	....	73.83	....	55.00	84.40
Heading	100.0	28.61	....	25.26	....	0.49	1.45	100.00	....	100.00	....	100.00	100.00
Sample No. 4—100-mesh													
Concentrate	30.0	45.50	2.80	14.64	....	0.60	1.05	61.58	68.89	16.71	....	13.33	4.00
Middling	27.6	24.00	0.93	24.60	....	....	....	29.86	20.87	25.86	....	....	....
Tailing	42.4	4.50	0.33	35.60	....	....	....	8.56	10.24	57.43	....	....	....
Heading	100.0	22.17	1.23	26.27	....	1.35	7.78	100.00	100.00	100.00	....	....	....
Sampe No. 5—table-middling, 100-mesh													
Concentrate	51.3	48.38	4.10	7.40	....	....	1.30	92.5	53.1	7.9	....	....	6.40
Middling added to tailing													
Tailing	48.7	4.08	3.80	38.60	....	....	19.30	7.5	46.9	82.1	....	....	93.60
Heading	100.0	26.80	3.95	22.28	....	....	10.30	100.0	100.0	100.0	....	....	100.00
Sample No. 6—table-middling, 100-mesh													
Concentrate	36.0	53.20	3.85	5.00	....	0.45	2.34	77.44	53.30	13.35	....	9.70	3.96
Middling	19.3	23.60	3.52	19.18	....	1.55	13.26	18.41	26.12	23.35	....	17.90	12.17
Tailing	44.7	2.30	1.21	22.45	....	2.70	39.44	4.15	20.58	63.30	....	72.40	83.87
Heading	100.0	24.73	2.60	15.85	....	1.67	21.02	100.00	100.00	100.00	....	100.00	100.00
Sample No. 7—mill-tailing, -80-mesh													
Concentrate	5.40	60.20	....	2.25	....	1.20	....	72.38	....	2.00	....	0.29	....
Middling	13.47	7.40	....	....	....	....	....	22.04	....	....	....	....	....
Tailing	81.13	0.32	....	....	....	....	....	5.58	....	....	....	....	....
Heading	100.00	4.40	....	6.06	....	21.96	7.48	100.00	....	....	....	....	....
Sample No. 8—table-middling, 80-mesh													
Concentrate	33.60	50.00	5.06	6.72	....	0.67	1.61	86.91	40.66	....	....	....	....
Middling	13.60	15.60	....	....	....	....	....	10.96	22.22	....	....	....	....
Tailing	52.80	0.87	2.86	40.56	....	....	....	2.13	36.12	....	....	....	....
Heading	100.00	19.33	4.18	27.12	....	0.92	5.00	100.00	100.00	....	....	....	....

with water before adding the frothing-agent, otherwise copper sulphides would float with the zinc sulphide. Copper thus floated showed a marked tendency to drop as the ammonia was eliminated in cleaning and re-cleaning the concentrate, and it appeared in the middling.

When ammonia is introduced into ore-pulp in conjunction with certain oils no differential action is manifested and all sulphides are floated. This is particularly true with coal-tar distillates. The most suitable oils for differential flotation are found among the wood products, especially neutral pine-oils and neutralized wood-creosotes.

As the oxide film or coating on the iron sulphides is only superficial, the best results are obtained in flotation cells giving the maximum amount of aeration and the minimum of scouring action. This is characteristic of the Callow pneumatic cell sold by the General Engineering Co. of Salt Lake City. Of mechanical types, the K & K machine put on the market by the Southwestern Engineering Co. of Los Angeles is considered efficient. There is evidence, but not conclusive proof, that an iron machine gives better results than cells constructed of other materials.

As a result of research for a period of over three years a vast amount of information relative to differential flotation of metalliferous sulphides has been acquired that cannot be given publicity at this time.

Although the accompanying data give some results of tests on zinc-iron sulphide ores, the process is applicable to differential flotation of other sulphides such as chalcocite, chalcopyrite, molybdenite, and graphite from pyrite or pyrrhotite. By a modification of this process good results have been obtained in separating galena from sphalerite.

The success of the process, like all others requiring addition-agents, largely depends upon the cost of such materials. Synthetic nitrogen products that can be reduced to ammonia are now manufactured in large quantities and afford a fairly cheap and abundant supply of this reagent.

EMULSIONS were discussed by W. P. Davey in the 'Physical Review' recently in which he gave a method that avoids the usual mechanical action. It was found possible to emulsify the oils used in making japan bases by merely heating them with an aqueous alkali solution, in this case NH_4OH, in an enclosed space. The emulsification was hastened by stirring with baffles at 30 to 60 r.p.m. Emulsions can be made therefore, (1) by adding all the alkali and a little H_2O, or (2) by adding all the water at the beginning. The first method gives an emulsion of greater fineness. All emulsions made as above form a surface scum on exposure to the air at room temperatures due to the CO_2 present, since air free from CO_2 gives no scum. A critical temperature exists, below which no scum will form, but above which the CO_2 seems to unite with the alkali in the surface-layer, forming an electrolyte, which breaks the emulsion at the surface, producing a scum. The droplets of the discontinuous phase of the emulsion are negatively charged, and this phase can be deposited upon the anode by electro-plating. The velocity of transport is of the same order of magnitude as the velocity of other colloids and ions at the same temperature.

DISCUSSING electrolytic zinc at the Colorado meeting of the A. I. M. E., C. A. Hansen stated: The requirement, and I use it in the singular, for the electrolysis of zinc is zinc sulphate, and zinc sulphate only. Most other elements found in the solution are harmful to the electrolysis of zinc sulphate. I never have found any that I could confidently say were beneficial. This requirement seems relatively simple, but when it is understood that this process is to be applied (generally) to a complex of ore minerals, it will be understood that the production of zinc sulphate, pure, of the standard strength, is not the easiest problem in the world. Yet it is only this problem that has stood in the way, for all time past, of the manufacture of zinc electrolytically. All of the factors necessary to the production of a solid coherent plate of electrolytic zinc were known long ago, but it is only recently that we have been able to produce this pure zinc sulphate on a commercial basis and in large quantities, and have been able to obtain the electric current at such a cost as to make the production of electrolytic zinc a commercial possibility.

ANTIMONY DI-OXIDE (SbO_2) may be prepared by heating Sb_2O_5 at bright redness, or by oxidizing Sb with concentrated HNO_3 and heating the resulting oxide at dull redness until constant in weight. When heated with concentrated HCl and KI, SbO_2 liberates iodine; the reaction proceeds according to the equation

$$2SbO_2 + 6HCl + 2HI = 2SbCl_3 + 4H_2O + I_2.$$

The iodine may be separated by distilling the mixture; if the distillate is collected in a receiver containing KI solution, titration with thiosulphate solution will give the quantity of Sb_2 present. Meta-stannic acid does not liberate iodine from KI under the above conditions, but the reaction is of little practical use for the estimation of antimony in the presence of tin, since alloys of these two metals usually contain other metals which interfere.—'Journal of the American Chemical Society.'

DEFINITION OF HARDNESS. W. Cawthorne Unwin, in 'Engineering', shows by mathematical analysis that the Brinell hardness-number is identical with Martell's hardness-number, provided both are expressed in the same system of units. It does not appear that the identity of the two has been pointed out before. In the Martell-test a weight faced with a hard steel conical point was dropped from a known height on the specimen. The reciprocal of the width of the impression was taken to measure the hardness. The hardness of a ductile material may be defined as the ratio of the steady load to the spherical surface of a ball indentation, or the work required to indent a unit-volume, or, more generally and simply, the intensity of pressure on the area of the surface indented at which the material yields or flows in the conditions of a test.

The Personal Element in Management

By A. M. HECKMAN

Twenty years ago mining communities clustered around one to a dozen small mines, each one employing 20 to 200 men; they had a 10 and often a 12-hour day; they had no business; they had no recreation; the Y. M. C. A. was unknown; the men had to go to their homes dirty and wet, for there were no modern change-houses. One could mention a hundred advantages that the miners of today have over those of yesterday. Yet today, in spite of these advantages, there seems to be more discord and dissatisfaction.

What is the reason for this condition? Is it because the education of the miner is so much better and that he demands more civilized conditions? Is it due to the natural unrest, or what is it? It is noticeable that disorderly labor conditions are more frequent where large organizations dominate. Troubles are not as likely to occur where there are ten mines each employing 200 men as where there is one man running ten mines and employing 2000 men. This gives us a hint as to where the trouble lies. It is true that big organizations and large capital have made ore where no ore existed before; they have made possible the working of extremely low-grade deposits, but with all this have come labor problems, many of which are not solved by largeness of organization.

It might be interesting to see why the small organization could exist under conditions that would soon call for a strike in a large one. It was because 'Bill' was the boss, and he was 'Bill' to everyone. The men could go to him and talk as man to man, whether the subject was the weather or how to run the mine. 'Bill' knew their troubles, their complaints, their grievances; he knew their families and how they were getting along. He was undoubtedly a man of superior judgment, or he would not have been made the boss. His superior judgment allowed him to forsee what his men were going to want before the men themselves had given it a thought, and the result was that 'Bill' was more than their friend.

When the organization grew to 500 men, however, 'Bill' did not have so much time to loaf around with the men; he was confined to his office more and more; he had to delegate work to others, and right at this point 'Bill's' mine began to suffer in its relation to labor. The personal touch was lost and the feeling that they, the workmen, were actually having a part in the working of the mine was gone. Previous to that time the men all felt that they were an important part of the organization. The change was not sudden, but it came about through the fact that the gradual change in the personnel made the boss unfamiliar with the new men; in a comparatively short time he gave an order "Send a man to do this or that," whereas a short time before it would have been "Ask Tom Jones to do this or that."

The personal touch has given way to the military system. Everyone in the organization, while he does not know his place by military name, knows his rank well enough, and too often he is made to feel his inferiority. The military system has grown up as the one substitute that fits all conditions, and that does not fit itself around the personality of one man, to be lost or destroyed by the removal or death of that man. It has grown up because of the fact that men of the necessary calibre to fit the manager's chair and operate under the personal system of management are rare, and the further development of the military method is going to make such qualities obsolete, unless steps are taken to use them.

From the point of view of satisfaction, contentment, freedom from labor troubles, real efficiency, there is no question about the superiority of the personal system of management. Its drawbacks, however, are evident. First, the difficulty of finding a man endowed with the rare gifts necessary for this type of management, and second, undermining of the organization whenever that man is removed, unless he has been sufficiently farsighted to select and train a successor. The advantage of the military method is that the organization is not disturbed greatly by changes in the personnel.

The personal method, which makes the workman feel more like a human being and less of a commodity, requires in its manager long residence along with the growth of the organization. It requires a man of remarkable breadth and versatility, and of unusual memory. It requires a man who is not irritated by trifles, who can put the man talking to him perfectly at ease. He must know how to be a father without being paternal; he must have human sympathy. It is true that a man with such qualities is rare, but he is still rarer when it is considered that he must be a technical man and a technical engineer as well.

Outside small organizations, there are but few opportunities to witness the methods and the results of the personal system of management in this country, but at the coal mines of the Phelps Dodge Corporation at its Stag Canyon branch at Dawson, New Mexico, it may be seen applied to a community of 5000 people. Dawson produces about 5000 tons of coal per day, the greater part of which is converted into coke. It is a company-owned community having all the advantages of a company-owned community—cheap rent, free water, cheap light, good schools, etc., without the usual restricted competition. The reason for it is that the management sees things through the eyes of the workmen.

In population, Dawson is like any other coal-mining town; it has many nationalities and many languages, but it is only in the physical characteristics that it is the same. There is a feeling of contentment among the employees that is hard to find elsewhere and there is a loyalty and co-operation seldom seen where a large company dominates the community. The workmen feel that they are well represented by the manager and that their interests are considered. They know that the manager is seeing things through their eyes, and they have a trust and a confidence in his uprightness and judgment that is almost childlike.

Dawson has a good climate and enjoys excellent health; it is considered a good place to work and to live. All the good things one may say about Dawson as an example of industrial content do not come from big parks, children's playgrounds, visiting nurses, and the many other things that have been used all over the country to provide for the satisfaction of employees without the personal touch. Barrels of money may be spent in creating or attempting to create a mental condition of satisfaction, and while in some cases it does create such a feeling, it is usually mixed with a feeling of gratitude for the many things provided. It is not meant that Dawson has none of these things, for a close finger is kept on the pulse of the community, and when it is seen that certain things must be improved, they do not wait for a committee of the workmen to ask for it.

One may ask the formula for this apparently ideal labor condition. Its formula is simple in so far as the ingredients are concerned, but difficult as to the mixing and the application of the proper dose. The ingredients are absolute fairness and equality irrespective of nationality, class, or color, true sympathy and interest in small things, an equable disposition, and the ability to see things in the light of the workmen. The difficulty comes in mixing these ingredients into one person and the ability of that person to administer them.

The personal element in management, as has been said, is a lost art, lost through lack of development, but wherever tried, it has been successful. It has not been lost through lack of appreciation of its value; it has been lost in the excitement of a rapid building of organizations, becoming replaced by the simpler military system. The fact that it is being lost, however, is beginning to be appreciated, as is shown by the interest taken in the well-being of the individual rather than of the mass.

In many organizations throughout the country men are being selected to furnish this personal touch, and while these men are usually broad enough to shoulder the work, their task is hopeless unless the management develops the same characteristics. The attitude "don't bother me with your troubles: take them to the Welfare department" is too commonly the reason for the failure of that department to obtain results. Of course, a manager who is far-seeing enough to establish a personnel department is usually ready to back it up, but too frequently there is no clear understanding on his part as to what should be backed up. Personnel departments are successful, and are the next best thing to the direct personal touch. Cold business is losing its sway, for labor objects to being classed as a commodity. True co-operation will come when both sides admit that the other side has a point of view and a right to that point of view. This attitude can come only by friendliness and the personal touch.

CHEMISTRY of gold at high temperatures and pressures was discussed by H. H. Morris in the 'Journal of the American Chemical Society' recently. Gold is soluble in solutions of $AuCl_3$, acid with HCl, at the boiling temperature. AuCl is formed, which may be titrated with $KMnO_4$. From this pure gold hydroxide is obtained. When heated with water this yields metallic gold at 322°; small amounts of inorganic salts lower the decomposition temperature as much as 70°. Calcite heated with $AuCl_3$ becomes plated with gold above 310°. $Au(OH)_3$ is first formed and then reduced to metal. Magnesite may be similarly plated and the crystals are of a different habit from those formed on calcite. $AuCl_3$ may be heated under pressure of aqueous vapor as high as the critical temperature of water before the gold separates. If small amounts of NaCl, $MgCl_2$, or $CaCl_2$ are added, $AuCl_3$ is much more stable toward heat, only incipient reduction being obtained at 450 to 600°. In these solutions calcite and magnesite are only slightly plated at 500°. $CaHCO_3$ is without effect on the stability of $AuCl_3$ toward heat, but $MgHCO_3$ acts like the normal salt, causing the formation of $Au(OH)_3$ and gold at 322°.

ESTIMATION of sulphur in pyrite may be made accurately as follows, according to Z. Karaoglanov, P. Dimitrov, and M. Dimitrov, as given in the 'Journal of the American Chemical Society: After the sulphur has been oxidized to H_2SO_4 by heating with a mixture of HNO_3 and HCl, or by fusion with Na_2CO_3 and KNO_3, the H_2SO_4 may be precipitated directly from the HCl solution obtained after separating the silica, previous removal of the iron being unnecessary if the precipitation is made under the following conditions: Dilute to 700 cc. the solution from 0.5 gm. of pyrite, which should contain from 30 to 50 cc. of 6/N free HCl, heat to boiling, and gradually add 40 cc. of hot 10% $BaCl_2$ solution diluted previously with 100 cc. of hot water while the mixture is stirred. Collect the precipitated $BaSO_4$ after 15 hours, wash first with water containing HCl and $BaCl_2$, then with hot water, dry, ignite, and weigh.

TIN PRODUCTION of the Federated Malay States is responsible for 40% of the world's total. In 1917 these four States yielded 39,833 tons, a decrease of 4037 tons when compared with the output of 1916. There is a total of 55,576 hp. used in recovering this metal, which is reduced from the oxide state at Penang and Singapore. The power-plants consist of steam, 23,748; steam-electric, 2420; hydraulic, 18,524; hydro-electric, 4395; suction gas, 1794; oil engines, 2692; and oil-electric, 2003 horsepower.

HOUGHTON, MICHIGAN

Copper Output Estimates.—Men Returning From Munition Centres.

The total output of copper for this district in 1918 will not exceed 210,000,000 lb., judging by the present indications. This is 70% of normal. Generally speaking there never was a time in the history of the larger and more important copper producers here when the newer openings showed a better grade of ore and a better chance to make profits than at present. The one handicap is the lack of men. There is no expectation of a betterment in the labor situation until next spring.

Mass Consolidated and Victoria have raised wages in proportion to the advance made by other mines. Some of the men from the Mass who went to Seattle, Washington, attracted by the stories of high wages, are returning. Others contemplate coming back. The experience has been costly to them.

PLATTEVILLE, WISCONSIN

Zinc, Lead, and Pyrite Mining in September.

The draft, influenza, power changes, and an irregular ore market were responsible for September being a rather unsatisfactory month. The output is now only 60% normal. The reserve of concentrate carried over from August, conservatively estimated in excess of 10,000 tons, was reduced somewhat, but at the close of September there was at least 8000 tons of all grades in the field.

High-grade ore prices suffered as well as the lower grades, as business for the month gained impetus. Allocated zinc ore for sheet metal started off on the usual basis of $75 per ton, but the best price reported the first week was $71.25. Then it dropped to $70, advanced again to $73.25, and closed at a premium, going to $75.80, the best price received so far this year. Second grades acted similarly, opening at $51 to $52.50, dropping $3, and closing on fairly good grades at $55 per ton, basis 60% metal. The lower grades were in poor demand at the beginning, and little ore sold in open market. Toward the latter part of the month prices showed improvement, offerings of $23.50 being made for separator feed, on a basis of 30% zinc.

Lead-ore producers fared well throughout September, the price offered remaining exceptionally firm at $100 per ton, 80% metal content. Some unexpected competition developed, and the freer deliveries showed that much of the ore sold and delivered had been held long in reserve. Competent authorities have stated that there was no reserve lead ore here, so it appears that producers are fairly clever in making this appear so. The price at the end of September in some cases was close to $105. There is still another 1000 tons in the field for which producers expect not less than $110 per ton.

Shipments of pyrite were larger than those of former months, but only open-market sellers profited from its sale. Firms held under contract will be glad when these agreements terminate at an early date. Others have received 25c. per unit of sulphur per long ton.

Shipments of ores during September, from mines to separating plants in the field and from mines to smelters direct, totaled as follows: blende, 13,069 tons; lead, 984 tons; and pyrite, 2608 tons.

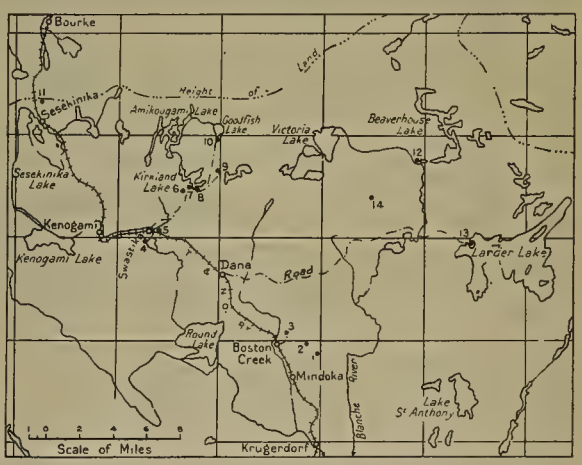
The Federal government established a labor agency at Benton, with T. M. Crowley in charge, in the heart of the zinc district, at which an effort is now being made to improve the labor situation as much as possible. The method employed is wrong. Competent miners have been taken in the draft at all points in the field until the industry is practically demoralized on this account, while zinc mining is regarded as an essential war indusry. It would not, in the estimation of patriotic citizens, be wrong for competent zinc-ore miners to claim exemption.

PORCUPINE, ONTARIO

Development in the Goldfields of Ontario.

Kirkland Lake.—Great activity prevails in this area. The Teck-Hughes mine, which has been closed for some months, is again being operated.

The decision of the English courts in litigation over the Tough-Oakes having put $150,000 into the company's treas-



PART OF ONTARIO, SHOWING POSITION OF THE KIRKLAND LAKE AND BOSTON CREEK GOLDFIELDS. THE NUMBERS ON THE MAP ARE THE FOLLOWING MINES, ACCORDING TO THE ONTARIO BUREAU OF MINES:

1.	Miller-Independence	6.	Kirkland Lake	11.	Smith-LaBine
2.	McRae	7.	Teck-Hughes	12.	Mine D'Or Huronia
3.	R. A. P.	8.	Lake Shore	13.	Goldfields, Ltd.
4.	Swastika	9.	Tough-Oakes	14.	Elstone-Dunkin
5.	Lucky Cross	10.	La Belle Kirkland		

ury, the mine is being unwatered and the mill cleaned-up for the resumption of operations.

The Ontario Kirkland, in which two veins of high-grade ore have been uncovered, has ordered an electrical equipment, and as soon as it is in place will sink a shaft.

At the Montreal Kirkland a shaft is down 50 ft., to be continued to the 100-ft. level.

The Wright Hargreaves will construct a 150-ton mill.

Rapid headway is being made in the development of the Burnside. One shaft is down 360 ft.; another is being sunk

on No. 6 vein, 750 ft. distant. A mill is to be built to treat 30 tons daily using amalgamation only.

Joseph Houston, formerly assistant manager of the Dome Mine, has been put in charge at the Kirkland-Porphyry, where the workings have reached a depth of 400 ft. The vein is 20 ft. wide in places, carrying high-grade ore.

The minority shareholders of the Orr Gold Mines, Ltd., from which the property was taken over by Kirkland-Porphyry, are dissatisfied with the arrangement, and litigation is threatened.

Boston Creek.—Important new discoveries have recently been made on the Rogers-Barnett group of claims, quartz stringers carrying free gold were found in a dike 40 ft. wide, apparently composed of altered basalt. This find, situated 8 miles south-east of the Miller Independence, considerably enlarges the known gold-bearing area, and many prospectors have staked claims in the neighborhood.

Another discovery on the Campbell claims shows high-grade gold ore associated with tellurides.

The O'Donald claims, staked in 1913, have been taken over under option by Robert W. Norrington and associates of Detroit, who agree to spend at least $1000 per month in development work.

Cobalt.—A new orebody has been found on the surface at the Buffalo, close to No. 5 shaft. The vein is 3 in. wide and carries several thousand ounces of silver per ton, with a good grade of milling ore on each side.

The Cobalt Provincial, closed for two months, will be reopened as soon as electric pumps have been installed. A flotation plant has been ordered.

Porcupine.—The Hollinger Consolidated is producing gold valued at upward of $500,000 per month, notwithstanding the shortage of labor and the inefficiency of many of those procurable. This will probably improve during the winter, when many out-door workers will seek employment at the mines. The mill is working only at about half capacity, but is understood to be making profits considerably ahead of dividend requirements, amounting to 1% (5c. per share) each eight weeks. Provided a full staff could be secured, the mill could be speeded up to between 3000 and 3500 tons per day.

At the Dome Mines, 60 men are carrying on operations, mainly on the 1250-ft. level, where a cross-cut is being driven toward the Dome Extension boundary. A contract has been let for driving a raise from the 800 to the 700-ft. level. The plan of development is understood to include opening levels at each 100 ft. down to the deepest working.

The new shaft being sunk at the Davidson, some distance north of the original workings, is down nearly 400 ft. Its object is to open a good orebody indicated by diamond-drilling at the 550 and 650-ft. levels, where it was 30 ft. wide and said to assay $24 per ton. In the old workings, an extensive body of good milling ore has been opened down to the 300-ft. level.

Important new discoveries are reported at the McIntyre, the best being an orebody averaging 15 ft. wide assaying $16 per ton, found in a winze put down 125 ft. from the 1000-ft. level.

YERINGTON, NEVADA

Operations of Bluestone M. & S., Nevada-Douglas, Empire-Nevada, Bluejay, Rockland, Silverado, and McConnell Companies.

The new flotation plant at the Bluestone mine is doing good work. Concentrate assaying 26% copper is shipped to Utah. In addition to the concentrate, 300 tons per day of oxide ore is sent to the Mason Valley smelter at Thompson. This smelter is not equipped for reduction of concentrate.

Nevada-Douglas is mining 100 tons daily from its mines at Ludwig and the western Nevada. A large amount of development is being done. On the 800-ft. level of the Ludwig, sulphide ore has been found. Some ore is also being extracted from the Casting Copper section. Many local people believe that this area will develop into the most valuable property owned by the company. The ore occurs as replacement deposits in limestone. A large tonnage has been mined in the past.

It is reported that a leaching-plant is to be erected at the Empire-Nevada. Sulphuric acid is to be used. Last winter, experimental work was done in a 20-ton plant in which ferric chloride was used. While the process was successful, further experiments showed that sulphuric acid was better adapted to the ore, which carries oxide and carbonate of copper. It contains little iron and is very silicious. The ore is found in an altered monzonite. In 1913 this ground was drilled by the General Development Co. A large tonnage of oxidized ore has been found, and the future of the property is considered excellent. J. E. Gelder is in charge.

E. J. Ross has made a number of shipments of oxide ore from the Bluejay mine east of Yerington. It occurs in irregular lenses in monzonite, near the surface.——Adjoining the Bluejay on the east is a property owned by L. W. Trankle and W. McDonald. A number of cars of 6 to 9% ore has been shipped from surface openings.

The Rockland mine in the Pinegrove district, south of Yerington, has suspended operations. This is the only gold mine in the district. Costs have increased so much that this was the only course. During the last 2½ years the mine yielded $350,000 of ore, and for a while made good profits. The ore is rebellious, but an extraction of 90%, with a loss of less than 1 lb. of cyanide per ton, was obtained. The vein has been explored for a length of 1500 ft., and the mine is said to be in better condition than at any time. In addition to the gold, the ore contains 2.5 oz. of silver, largely in arsenic and antimony minerals. The mill treated 45,000 tons, of which 6000 tons was old dumps and tailing. The average of the mine ore was $8.50, and the average silver obtained was 65c. The newer workings show some increase in the amount of silver. The capacity of the mill was 75 tons per day, but shortage of water limited this to 50 tons actually treated. A dewatering filter would solve the tonnage question, but the property never was properly financed and money could not be raised to put in the needed equipment. It is locally believed that if sufficient capital had been provided the mine would have paid good dividends, and if the mill were operated to capacity profitable operations would be easily possible. The management was good, and operating costs were low. The present equipment is excellent and complete.

The Silverado mine at Sweetwater is erecting a cyanide-plant. It is planned to crush the ore to 30-mesh by stamps and to leach it. The value is practically all in silver, in the form of argentite and chloride. An attempt was made to concentrate this on tables, but extraction was low on account of sliming. A considerable amount of high-grade ore has been shipped to smelter.

The McConnell Mines Co. continues to make small shipments of ore. This property is just south of the Mason Valley, and has the largest body of limestone, in which the ore is found, of any property in the district, except the Mason Valley. It is the general opinion that this can be developed into a large property, but the owners lack capital, and have contented themselves with extracting the easier minable orebodies near the surface.

Luning.—It is said that the Jumbo Copper Mountain company's property north-east of this place, shows enough ore to warrant erection of a large mill. A large quantity carries 8% copper. Tests have been satisfactory, but construction will probably be deferred. L. L. Dellinger is superintendent and J. K. Turner is consulting engineer.

ALASKA

Juneau.—Alaska Gastineau during September milled 47,850 tons of $1.247 ore. This is just half of the August tonnage, and 12 cents lower in value, due to storms and other troubles.

Kennecott.—Copper production of the Kenecott Corporation in August was 5,280,000 lb. In July the output was 5,090,000 lb., and in June 4,044,000 pounds.

Valdez.—At the Midas mine of the Granby Consolidated, near here, Boyles brothers, diamond-drill contractors, drilled 54 ft. in eight hours with a 22-hp. Ford gas engine attached to a U. G. Longyear machine. The ground varied in character, and eventually cut a good grade of copper ore. This is the largest footage drilled by a diamond-drill in Alaska in this time, by means of any power. Gus Reardon operated the machine.

ARIZONA

Ajo.—New Cornelia has more than 100 men working underground. Sulphide-ore shipments to Douglas have increased to six cars daily. A sixth solution storage-tank, and an addition to the fine crusher, are under construction. Preparatory work for the addition of another motor-generator set has been started.

Bisbee.—The shaft of the Denn-Arizona is being sunk to the 1800-ft. level.

Shattuck-Arizona produced 686,844 lb. of copper, 325,496 lb. of lead, 8621 oz. of silver, and 106 oz. of gold during September.

Douglas.—Copper production of the Phelps Dodge properties in September totaled 15,500,623 lb. This is about the same as in September of 1917, but 2,500,000 lb. below the average for 1918.

Jerome.—After a shut-down of over two years, sinking at the shaft of the Dundee-Arizona, which was down 500 ft., has been resumed. The tunnel of the United Verde Extension has drained the ground so that the shaft is dry, and no water is expected for some time.

The United Verde Extension has just completed erecting a second 250-ft. twin oil-balanced turbine-pump.

Miami.—The Miami Copper Co. produced 5,012,865 lb. of metal in September, well above the average for 1918.

Prescott.—The Phelps Dodge Corporation has re-opened the Snoozer property at Senator. A new hoist has been erected, development is under way, and several carloads of ore have been shipped to the smelter at Douglas.

Ray.—Copper output of Ray Consolidated in September was 7,250,000 lb., well up to the average.

Winkelman.—A rich silver-gold strike has been made eight miles north, near the old Christmas mine. A stamp-mill has been erected. A four-mile road to the mine is under construction.

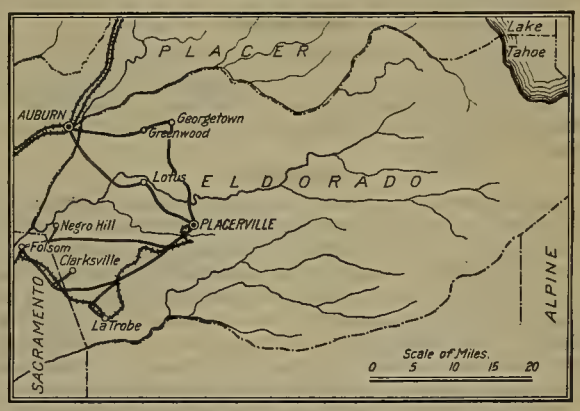
Yuma.—The Red Cloud mill in the Silver district has been destroyed by fire, the estimated loss being $100,000.

CALIFORNIA

Big Pine.—W. A. Sanger has applied to the State Water Commission for a permit to use ½ cu. ft. per second of the waters of Deer creek, Inyo county, for development of tungsten mines and for milling purposes. Water will be diverted by a dam 3 ft. high, 20 ft. long on top and 6 ft. long on bottom, and conveyed by pipe-lines 1¾ miles long. The estimated cost of proposed construction is $6000.

Bishop.—Gaylord Wilshire reports that development at the Wilshire Bishop Creek mine has been successful this summer. An 80-ton flotation plant, made by the K & K Co., is being erected, and is expected to be in operation by November 1, working through this winter. The K & K tests indicate a recovery of over 90%. The mine was shut-down in the fall of 1915 owing to low extraction by cyanidation, also on account of the lower grade of the ore. Development this summer on the 300-ft. level is stated to have opened a continuation of the main vein, showing a width of 22 ft., assaying $21 gold per ton. A drift has been driven 70 ft. on this new shoot with the face still in good ore. The drift is being continued.

Placerville.—The Greenwood and Georgetown districts at present are two of the principal regions producing chrome



ELDORADO COUNTY, CALIFORNIA, SHOWING SITUATION OF CHROME DEPOSITS.

ore in El Dorado county. The Negro Hill, Clarksville, and Latrobe districts, in the extreme west end of the county, are also large producers of the ore. The Shepard, Castillo, Federwitz, and Johnson leases are four of the big producers in the two first named districts. A. H. Simpson, of Placerville, general manager for the Union Chrome Co. of San Francisco, states that shipments of about one carload of 60 tons capacity per week are being made from the said four lease-rights. At the Johnson lease, 2½ miles east of Lotus, there is said to be over 50,000 tons of 30% chromite available, and good indications for a much greater tonnage. The ore is all hauled on big Moreland auto-trucks to the Placerville railroad station and loaded onto the S. P. cars. Johnson and Fitzlaaf have the contract of trucking the ore to Placerville, the railroad, mining, and financial centre of El Dorado county.

Grass Valley.—The North Star company has passed its quarterly dividend. The president, G. B. Agnew, states that

costs have risen steadily, and lately, owing to a shortage of labor, milling has been curtailed. All development has been stopped. Additional taxation has had its share in cost of operations. If the only question involved were that of profitable or non-profitable operation, it might be advisable to close the mine for the present; but various other considerations must be kept in view, such as the importance to the Government of the gold produced and the dependence of the town of Grass Valley on mining.

The company's cash resources will enable it to keep the mine in operation and good order, although no considerable profit can be expected under existing conditions. The directors look forward with confidence, on the strength of past developments, to a resumption of profitable operations and the payment of dividends after the termination of the War.

Keswick.—A Gibson mill is being erected at the Scottish Chief (Menzel) mine on Flat creek. It will be ready by mid-November.

Shawmut.—The Belmont-Shawmut Mining Co. has applied to the State Water Commission for a permit to use 1 cu. ft. per second of the waters of Woods creek, Tuolumne county, a tributary of the Tuolumne river, for mining purposes.

Sierra.—The Shamrock gold claims near here have been bonded by J. Mansfield to H. A. Hail and S. V. Hubbard for a large sum.

Yreka.—It is reported that a number of hydraulic mining companies in the Klamath and Salmon districts are preparing for early operations. Recent rains have replenished the water-supply. The rain has damaged roads, interfering with haulage of chrome.

COLORADO

Cripple Creek.—The Cresson company paid 10c. per share, $122,000, on October 10. The total is now $6,905,163.

The Portland company pays 2c. per share, equal to $60,000, on October 21. This makes $180,000 for 1918, and $11,257,080 to date.

GEORGIA

Cartersville.—Manganese ore in this district has been examined recently by Lawrence La Forge of the U. S. Geological Survey, J. P. D. Hull, assistant State geologist of Georgia, and W. R. Crane of the U. S. Bureau of Mines. The deposits are in a belt 1 to 3 miles wide and 18 miles long on the east side of Coosa valley, in the eastern part of Bartow county. The result of the investigation was encouraging. The area has been worked for many years, and estimates of reserves give at least 100,000 tons of high-grade ore and perhaps 250,000 to 300,000 tons of manganiferous-iron ore. Twenty mines are now operating. Recent shipments of 1600 tons averaged 42% Mn, 6% iron, 6% silica, and 0.14 to 0.20% phosphorus. Wages are $2.50 per day of 10 hours. The cost of ore on cars is $4 per ton. The monthly output is now 300 tons, but could easily be increased to 4000 tons.

IDAHO

Dividends paid by companies operating in this State during the third quarter of 1918 are as under:

*Hercules	$750,000
*Bunker Hill & Sullivan	490,500
Hecla	150,000
Caledonia	234,450
Tamarack & Custer	106,575
Federal	209,757
Richmond	8,400
Total	$1,949,682

*Estimated.

Kellogg.—In a drift from the bottom of the 275-ft. incline shaft of the Coeur d'Alene Antimony Co. high-grade stibnite was opened recently. The mill is reported to be making a good recovery by flotation. M. E. Jolley is president of the company.

Mullan.—Consolidated Interstate-Callahan pays 75c. per share, equal to $348,743, on October 21. This makes $813,733 for 1918, and $7,091,098 to date. C. W. Newton is general manager.

The Idaho-Carbonate Hill Consolidated M. Co. deepened its shaft 115 ft. in each month of August and September. It is to be sunk to 800 ft., having been started at 1200 ft. from the portal of the tunnel. The mine is well equipped. Twenty men are employed in charge of W. D. Greenough.

KANSAS

Baxter Springs.—The 300-ton mill of the Lucky Jenny Mining Co., four miles west, is ready for work. The plant is motor driven. It includes Rogers crushers, four sets of rolls, and three jigs. Sixteen holes drilled on the lease showed 3.6 to 19.9% blende, with some lead in places. The dump contains 25,000 tons of rich ore. Ira Turner is president.

Treece.—The new 400-ton mill of the Kansouri Mining Co. is nearly complete. Two shafts are in ore at 236 and 270 ft. depth.

MISSOURI

Joplin.—Production of the Tri-State fields last week totaled 7670 tons of blende, 271 tons of calamine, and 1756 tons of lead. These averaged $57, $39, and $100 per ton, respectively. The total value was $621,713, making $19,083,542 for 40 weeks. Missouri contributed $120,597 last week.

MONTANA

Butte.—Production of Butte & Superior in September was 32,000 tons of ore, yielding 9,500,00 lb. of zinc and 180,000 oz. of silver. The respective figures for August were 39,000 tons, 11,250,000 lb., and 220,000 oz. The I. W. W. troubles were the cause of the reduction.

North Butte pays 25c. per share on October 28. This makes $1 for the current year.

Wickes.—Regular shipments of silver-lead ore are being made to East Helena smelters from the Mt. Washington mine.

The Blue Bird copper mine is shipping ore to smelter.

NEVADA

Ely.—Nevada Consolidated yielded 6,670,415 lb. of copper in September, somewhat above the average output.

Goldfield.—Florence Goldfield has adjusted all claims against it, and the receiver, H. B. Clapp, has finished his work. Cash on hand is now $1872. Six lessees are working. The Florence went into the hands of the receiver November 23, 1916, since when the holdings in Goldfield have produced close to $250,000 gross, including the sale of from $25,000 to $30,000 of machinery, according to the 'Tribune'. The $2764 suit of the Western Ore Purchasing Co. against the receiver, arising from an alleged shipment of salted ore by a lessee, was dismissed by the Court. It is understood that this claim will be settled by agreement between the plaintiff and the Florence. Eight cars of ore are now in transit.

Gold Mountain.—The Tonopah Gold Zone is said to have found the extension of the Tonopah Divide vein on the 300-ft. level. The ore was cut 320 ft. north-west of the shaft. For 65 ft. assays yielded from $1 to $14 per ton. The shaft is to be sunk 200 ft. deeper.

The Tonopah Divide's new electric equipment is working smoothly. The shaft is to be sunk another 100 ft., making a total of 470 ft. The mine is to be thoroughly opened. From 100 to 200 tons of ore is to be sent weekly to the Gold-

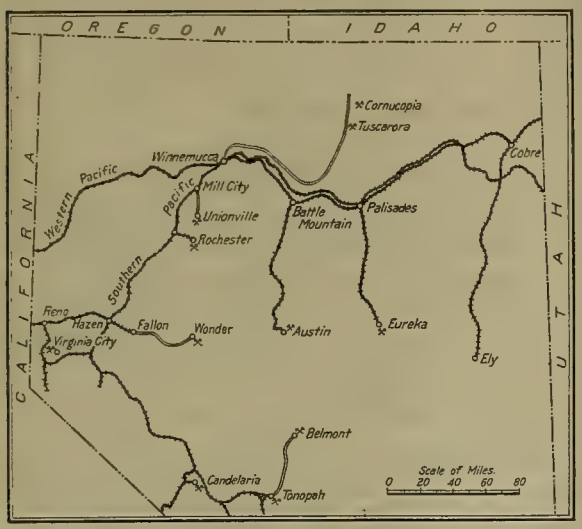
field Consolidated mill. This ore goes by team or auto-truck to the Klondyke station on the T. & G. line, where it is loaded on cars.

The Brougher Divide has done 300 ft. of work on its 300-ft. level, and will sink its shaft 200 ft. deeper.

Rochester.—In the 'Press' of October 12, a map showing the silver districts of Nevada unfortunately failed to show Rochester, the second of importance in this State. The accompanying new map has made good this deficiency.

The Rochester Mines Co. reports that at a depth of 100 ft., in block 4, high-grade ore has been found; also on the 250-ft. level under the above.

Tonopah.—The West End has connected the Ohio workings with No. 2 shaft, on the 800-ft. level, and is now tramming ore to No. 2 by an electric locomotive made at the mine. This will reduce haulage costs. The mill last week treated 983 tons of West End ore, 202 from lessees at the Montana, and 119 from the Rescue-Eula. The last mentioned has 5½ ft. of ore on its 1050-ft. level.



MAP SHOWING PRINCIPAL SILVER DISTRICTS OF NEVADA.

The Belmont continues deep exploration, results on the 1200, 1300, and 1400-ft. levels being very satisfactory.

The Extension is cutting a station at 1776 ft. New development last week amounted to 168 feet.

NEW MEXICO

Santa Rita.—Chino Copper Co. produced 7,936,000 lb. in September. This is a gain of 2,900,000 lb. over August, and the largest output since December of 1917.

OKLAHOMA

Bartlesville.—The three zinc smelters here are at full capacity, employing up to 1200 men. There are 12,896 retorts distilling metal, producing pure zinc, zinc oxide, and zinc dust.

Picher.—Production of the districts last week totaled 4838 tons of blende and 1345 tons of lead, valued at $409,076.

Quapaw.—The Bethlehem Zinc Co. has closed its mine and mill on account of labor shortage.

TEXAS

Terlingua.—The Mariposa Mining Co. has leased the quicksilver furnace of the Terlingua company. The plant, which has a daily capacity of 50 tons, is now in regular operation. The Mariposa company is also a buyer of custom cinnabar ore, and has purchased large quantities of lean ores from dumps. In one lot purchased recently there were 32,000 tons of ore, estimated to contain $241,000 worth of mercury. F. M. Dancy, of Philadelphia, Pennsylvania, is president.

UTAH

Bingham.—Utah Copper Co. produced 17,785,000 lb. in September, almost the same as in this month of 1917.

Salt Lake City.—The Vipont Mining Co., operating in the Ashbrook district of Boxelder county, contemplates erecting a 250-ton concentrating plant. C. A. Phillips of this city is president.

WASHINGTON

Leadpoint.—The new Riblet aerial tram at the Electric Point mine has been tested, and is in regular service. It will carry up to 300 tons daily if enough miners can be procured. Compared with the cost of hauling lead ore by wagon, there is expected to be a saving of $1.50 per ton.

CANADA

British Columbia

Anyox.—Granby Consolidated pays $2.50 per share, equal to $374,962, on November 1. This makes $1,499,848 for 1918, and $10,573,857 to date.

Coke is to be made here in a new plant being erected by Granby Consolidated. Owing to various delays, says 'Granby News', the works cannot be completed until next winter. The coal mined at the company's property at Cassidy, Vancouver island, is delivered at Anyox in barges. The unloading-dock has a high tower containing machinery for operating the buckets used in discharging. These buckets deliver onto an inclined belt-conveyor, which in turn delivers to a shuttle-conveyor situated on top of the coal storage-bin, and which distributes the coal as required. This bin contains 50 buckets, and has a capacity of 12,000 tons. The coal is next delivered through gates in the bottom of the bins to a horizontal conveyor and is carried to a two-stage bucket-elevator, the first stage depositing the coal into a crusher and the second into the bins over the ovens. This part of the work, with the exception of the two-stage elevator, is practically complete. There will be 30 ovens. They are 75% finished.

The tar from the gas is collected in mains and delivered to the tar storage-tank. A considerable part of this tar will be used as fuel in the power-plant, the boilers being equipped with suitable burners. The gas from the ovens passes through the coolers and purifying processes on to the scrubbers, then to the gas storage-tanks, when it is ready for distribution. A part of it will be used in the ovens for heating purposes, but a considerable surplus will be left that will be available for blast-furnaces, pre-heating furnaces, and forges, and may also be used for domestic purposes.

The buildings will be of fireproof construction, and at present the foundations are nearly complete. The power-house foundations are also in and this building will be rushed in order to install the boilers and machinery during the winter. The two Custodis brick chimneys are completed. A dam has been built at Carney lake, and a 16-in. pipe-line will be run from there to the power-plant for a water supply. This work is 60% completed.

Nelson.—In the Mines Report for 1917 the Eureka mine of the Nelson division is referred to as the chief copper producers. Improvements in equipment were under way that would permit the shipment of 50 tons daily some time in 1918. Recent news is to the effect that this work has been completed, and that the output can be increased to this tonnage. A lease has been taken on the power-plant of the Kootenay Gold Mines, and an air pipe-line 6000 ft. long has been put down. Machine-drills have been installed, thus doing away with hand-drilling. Other work done in-

cludes repairing of the tramway and wagon-road, and timbering of the mine. The Eureka has shipped 5000 tons of ore, has 9000 tons blocked out, and it is considered that the prospects of developing a large tonnage are excellent. The ore averages $15 per ton in silver and copper. The Inland Mining Co., with headquarters at Walla Walla, Washington, has taken over this mine from the original Eureka company.

Revelstoke.—Some rich copper ore has been opened on a new property in Arrowhead Lake district, near Revelstoke. The claims are near water transportation.

Trail.—The Consolidated M. & S. Co.'s plant received a total of 6155 tons of ore during the last 9 days of September, as follows:

Mine	Tons
Bluebell, Riondel, B. C	98
Center Star, Rossland, B. C	1406
Cork Province, Zwicky, B. C	45
Couverapee, Field, B. C	120
Emerald, Salmo, B. C	131
Electric Point, Leadpoint, Washington	176
Florence, Princess creek, B. C	45
Iron Mask, Kamloops, B. C	49
Josie, Rossland, B. C	819
Lucky Jim, Kaslo, B. C	50
Molly Gibson, Kitto Landing, B. C	106
Mandy, Le Pas, Manitoba	402
Mountain Chief, Renator, B. C	114
North Star, Kimberley, B. C	159
Paradise, Athalmer, B. C	110
Queen Bess, Sandon, B. C	151
Reardon, Clines, B. C	67
Silversmith, Sandon, B. C	49
St. Eugene, Moyie, B. C	42
Sullivan (zinc), Kimberley, B. C	1707
Sullivan (lead), Kimberley, B. C	217
Van Roi, Silverton, B. C	92

Ontario

Kirkland Lake.—The Teck-Hughes mine, closed for some months, is said to have been re-opened. If enough men can be procured the 80-ton mill will resume ore treatment.

Matachewan.—After working for 400 days in this new goldfield, the Nipissing company of Cobalt has withdrawn.

Porcupine.—Hollinger Consolidated paid a dividend of 1% (5 cents) on October 7. This amounts to $246,000, making $738,000 for 1918, and $8,772,000 to date.

The Hollinger company's mill is treating between 1400 and 1500 tons of ore daily, averaging around $12 per ton.

The Dome Mines has let a contract for raising between the 700 and 800-ft. levels.

The Dome Mines company, with sixty men, is developing on the 1250-ft. level, driving toward the east.

MEXICO

Hidalgo

Pachuca.—Santa Gertrudis, during the quarter ended June 30, made an operating profit of $384,000. The mill treated 69,114 tons of ore, yielding bullion worth $1,040,000. Underground work consisted of 319 ft. in ore, 579 ft. in unprofitable ore, and 839 ft. in rock. The plant worked at 70% capacity; the further reduction was made to conform to a modified and more efficient treatment system. With the arrival of more filter equipment, due within the next quarter, the tonnage will be increased. Aluminum dust is being used in place of zinc-dust for precipitating silver and gold from solution; considerable saving is already assured by this change, which is still under trial. During the period, an examination of the Bordo mines in this district was completed and arrangements made to work them under a 20-year lease. The equipment and further development of these properties is in hand.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

W. L. Gazzam, of Portland, was here last week.

J. P. Crowder has joined the Army and is at Camp Cody, New Mexico.

J. Nelson Nevius was in San Francisco on his way from Los Angeles to Nevada.

William Thomlinson has become secretary to the Vancouver Chamber of Mines.

Robert Chartran, engineer to the Lena Goldfields, in Siberia, is at the Argonaut hotel.

Gerald Sherman of Bisbee, Arizona, is on a visit to **Arthur D. Foote** of Grass Valley, California.

P. A. Robbins, manager for the Hollinger Consolidated Gold Mines, has joined the U. S. Army.

L. S. Cates, general manager for Ray Consolidated Copper Co., was in San Francisco during the past week.

Benjamin F. Tibby passed through San Francisco on his return to Salt Lake City from Downieville, California.

M. E. Cassidy, of Bisbee, has received a commission as Captain in the Army and is now at Camp Cody, Wyoming.

Arthur Notman, assistant superintendent for the Copper Queen Consolidated, has joined the Engineer Corps of the Army.

D. C. Jackling has been elected president of the Butte & Superior Mining Co., in succession to the late N. Bruce MacKelvie.

H. D. McCaskey, of the U. S. Geological Survey, was here last week conferring with Charles G. Yale, and is now at Denver.

George H. Garrey, who has been ill for the past three or four weeks, is able to be around again. He is at the Palace hotel.

F. G. Lasier, of Detroit, has received a commission as Captain in the Engineer Corps and been ordered to Camp Humphreys, Virginia.

A. L. Dowdell, formerly superintendent of the cyanide plant at the Empire mine, Grass Valley, is now in France with the Signal Corps.

Rudolf Gahl, formerly at Miami, Arizona, has opened an office as consulting metallurgist in the First National Bank Bdg., Denver, Colorado.

C. W. Purington sailed on the 'Tenu Maru' from San Francisco on October 15 on his way to Siberia, by way of Yokohama and Vladivostok.

Roy H. Allen, mining engineer and manager for the Tennessee Mining Co., at Joplin, Missouri, has been appointed Captain in the Quartermaster Department of the Aviation Service.

Harry J. Wolf, professor of mining in the Colorado School of Mines, has an article on 'Common Methods of Determining Latitude and Azimuth Useful to Engineers and Surveyors,' in the current issue of the 'Quarterly.'

E. K. Soper, professor of economic geology and dean of the Oregon State School of Mines, has returned to Corvallis, Oregon, after three months spent in geological work in the Atlantic Coast and Great Lakes regions.

THE METAL MARKET

METAL PRICES

San Francisco, October 15

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	12
Zinc-dust, cents per pound	15

ORE PRICES

October 15

Antimony, 45% metal, f.o.b. California, per unit	$1.10
Chrome, no definite quotations available.	
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.80—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% Mo_2S	$1.25
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$25

EASTERN METAL MARKET

(By wire from New York)

October 15.—Copper is unchanged. Lead is scarce and firm. Spelter is quiet though steady.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

	New York,	London,
Oct. 9	101.12	48.81
" 10	101.12	48.81
" 11	101.12	48.81
" 12	101.12	48.81
" 13 Sunday		
" 14	101.12	48.81
" 15	101.12	48.81

Average week ending

Sept. 3	101.12
" 10	101.12
" 17	101.12
" 24	101.12
Oct. 1	101.12
" 8	101.12
" 15	102.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	86.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	90.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

A cable from Peking on October 8 stated that diplomats of the Allies, with the exception of the Japanese, have approved China's application for an embargo on the export of silver. The Chinese officials are formulating the conditions, which will be forwarded to the foreign banks at Shanghai for their consideration.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date	
Oct. 9	26.00
" 10	26.00
" 11	26.00
" 12	26.00
" 13 Sunday	
" 14	26.00
" 15	26.00

Average week ending

Sept. 3	26.00
" 10	26.00
" 17	26.00
" 24	26.00
Oct. 1	26.00
" 8	26.00
" 15	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

Concentrate, matte, or blister from Canada, Cuba, Mexico, and South America may now be imported containing only 50% copper. The former ruling of the War Trade Board was 60%.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
Oct. 9	9.10
" 10	9.05
" 11	9.05
" 12	9.00
" 13 Sunday	
" 14	9.00
" 15	8.95

Average week ending

Sept. 3	9.42
" 10	9.41
" 17	9.62
" 24	9.76
Oct. 1	9.55
" 8	9.31
" 15	9.02

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

The weekly spelter report of the U. S. Geological Survey shows that in the last week of September the output of all grades was 10,520 tons. Stocks are 1957 tons less at 41,318 tons. Imports were 1706 tons, and exports 5430 tons

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date	
Oct. 9	8.05
" 10	8.05
" 11	8.05
" 12	8.05
" 13 Sunday	
" 14	8.05
" 15	8.05

Average week ending

Sept. 3	8.05
" 10	8.05
" 17	8.05
" 24	8.05
Oct. 1	8.05
" 8	8.05
" 15	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date	
Sept. 17	120.00
" 24	120.00
Oct. 1	120.00
" 8	120.00
" 15	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.50
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ORES

Antimony: There have been no developments in the market here.

Manganese alloys: There have been fairly large sales of spiegeleisen, totaling about 6000 tons for delivery this and next year. The quotation is firm at $75, furnace, for 16% alloy, and $82 for 18%. Ferro-manganese is still easy at $250 delivered for 70% alloy plus or minus $3.50 per unit above or below this standard. The spiegeleisen output of American furnaces in September will be the largest ever recorded. Uncompleted returns indicate an output for the month of over 37,000 tons, with the production of ferro-manganese at close to 26,000 tons.

Molybdenum: The market is nominal at about $1.25 per lb. of MoS_2 in 90% material.

Tungsten: No further news of a definite nature has come out regarding the inter-Allied pooling of tungsten resources. A fair business continues to be done at the prevailing prices of $19 to $25.50 per unit in 60% concentrate, depending on the quality of ore. Ferro-tungsten is unchanged at $2.40 to $2.50 per lb. of contained tungsten. Exports continue large.

Eastern Metal Market

New York, October 9.

Comparative dullness pervades all the markets and open demand is very light.

Copper output is reported as having improved to some extent. Interest centres in the price to be effective after November 1.

Indications point to the putting into effect of international control of tin. There is no buying.

Lead is as scarce and light as ever, and is under very strong control.

Zinc continues to fall, with demand exceedingly light.

Antimony is fairly steady.

Pig-iron production in September was at the rate of 113,942 tons per day, the highest rate in the history of the industry, representing a gain of 4600 tons per day over that of August. The September total was 3,418,270 tons, or 113,942 tons per day, against 3,389,585 tons in August, or 109,341 tons per day; yet fourteen furnaces blew out last month and seven blew in, making a net loss of seven. The total in blast October 1 was 365. September production was at the rate of more than 41,500,000 tons per year, against less than 40,000,000 tons per year as the August rate, while the official figures for the first half of the year were only 18,227,730 tons. The fact that October, with its 31 days and its generally favorable weather is always set apart for record-breaking, points to a continuance of the good work of last month. The Steel Corporation's report for the past week shows 92.7% of blast-furnace capacity and 100% of ingot-capacity in operation, against 92 and 97.8% respectively in the preceding week. A further statement from the Steel Corporation concerning the eight-hour basic day shows that the rate of pay for Sundays and holidays will be the same as for other days. In blast-furnace labor, where each man gets one day off in seven, it will be the policy to pay straight rates for eight-hours' work on Sunday and time and a half for the additional hours.

Orders from the Allies have materially increased, and some re-arrangement of priorities may be necessary in view of the more acute situation developed this week. A large northern Ohio shell-forging plant was closed for three days for lack of steel, and is now working at only two-thirds capacity.

COPPER

With most consumers covered until November 1 there has been in the last few weeks little other buying. In a regulated market, such as this, those using copper for war-work know they can secure what they need when they require it, and there is no need of competitive buying. There have been some sales for delivery after November 1, but at the fixed price which may rule at that time. A decision as to what price shall rule after the present 26c. per lb. expires by limitation November 1 will probably be decided between October 15 and 20. Those who have apparently devoted considerable thought to the question argue that there is no reason for any advance or any decrease. They say that there has been an increased output of crude and refined copper as well as larger importations of crude copper and lesser exports of refined thus far this year. Against this is cited the assertion that refining costs have gone up as well as a 10% advance in wages during September, made by the refiners. It is contended that the available supply of copper is about equal to our own needs and to those of our Allies. The price which jobbers are allowed to charge is 27.35c. per pound.

TIN

News regarding the international situation is only by inference, as no definite official information, or other reliable kind, is available. Conditions point to international control and to an elimination of importers in this country, although these still know nothing about their future. A significant fact is that in the last week there have been no offerings of Straits or English tin. Were the market free it is likelly there would have been some offerings. Another straw which may indicate which way the wind is blowing is a daily press statement last week that licenses for shipment of such tin were being issued only to the United States Steel Corporation. There is no assurance that these statements are true, and future developments must therefore be awaited. In the meantime consumers are remaining out of the market. Chinese and Banca tin, when offered at all, are still at high prices, and there is no indication that these producers will join the international agreement. The prompt market for Straits tin continues nominal at 82c. per lb., New York. Tin arrivals for September were high, as announced by the New York Metal Exchange. The total was 5454 tons, of which 3989 tons came in at Pacific ports. The amount in stocks and landing on September 30 was 275 tons. The monthly deliveries have grown steadily since 1913. In that year they were 3658 tons per month; in 1917 they were 4823 tons per month and, to October this year, they have been 5298 tons per month. To October 1, 1918, the total imports have been 47,428 tons as compared with 44,837 tons to October 1, 1917.

LEAD

The agreed prices on lead continue at 7.75c., St. Louis, or 8.05c., New York, for carload and larger lots, and there is no present prospect of these being changed for some time. All available supplies are being allocated, according to war needs, by the Lead Producers' Committee, which is doing this satisfactorily. There is little demand outside of that having to do with the War. The crux of the situation is output, and if this can be maintained at the maximum by the refineries, it is felt that these essential needs can be met.

ZINC

Some felt a week ago that the market would ease no further, but they have been disappointed. Quotations have fallen a few points almost daily. Yesterday prime Western was quoted at 8.80c., St. Louis, or 9.15c., New York, for October delivery, with spot-metal at about 8.90c., St. Louis, or 9.25c., New York. For November or December the quotation was about 8.75c., St. Louis, or 9.10c., New York. These prices were largely nominal, as the demand is exceedingly light and the market has not been tested. Nor are producers forcing their product. Grade A zinc is officially held at a maximum of 12c. per lb. base.

Sheet zinc has a maximum Government price of 15c. per lb. with plate zinc at 14c. per pound.

ANTIMONY

There is little change; the quotation is still 14c. per lb., New York, duty paid, for large lots for early shipment, but this could apparently be shaded under certain conditions.

ALUMINUM

Government fixed maximum prices control the market for No. 1 virgin metal, 98 to 99% pure and for scrap at 33c. per lb. for 50-ton lots, at 33.10c. per lb. for 15 to 50-ton lots, and at 33.20c. per lb. for 1 to 15-ton lots.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

RE-MANUFACTURING USED PIPE

In the iron and steel industries there is an acute shortage of raw material and a necessity for salvaging every available pound of scrap-iron or steel. Not only does this apply to the iron and steel foundries but to the concerns compelled to use iron or steel pipe in construction work. It has been found that used pipe may be re-manufactured and brought to a point where it may fulfil the requirements of engineering specifications. The Pacific Pipe Co., shortly after the San Francisco disaster, conceived the idea that old pipe could be salvaged and re-constructed to a point where it would serve in place of new material. They commenced operations at the corner of Main and Howard streets, where they installed considerable machinery. These machines consisted of devices for re-threading, steam-testing, cutting and welding, re-dipping, and straightening.

The company had entered into a business of which there was no other of its kind in the western part of this country. The sale of their product increased so rapidly that it became necessary to acquire in addition to the Howard street plant, the major portion of a block of land at the corner of Main and Bryant streets. Here they erected a building comprising about 10,000 sq. ft. of ground area and installed the best machinery possible to obtain, including the largest pipe-threading machine west of the Mississippi river. The company has a spur-track so that it can load at its own doors.

In re-manufacturing its pipe the Pacific Pipe Co. tests every foot to 120 lb. steam pressure, and every weakness is welded or remedied, as the case may require. The bends and crooks are straightened and all defects obliterated.

The market for the product of this company extends over the entire Pacific Coast as far east as Utah, and in the last two years a large trade with the countries westward across the Pacific has developed. Their customers are among the large light and power companies, irrigation enterprises, water companies, oil and mining companies, and all who have used pipe in large quantities. The Winter Garden Skating Pavilion, which gained prominence throughout the West while it was in operation in San Francisco, was equipped with a refrigerator-system comprising over ten miles of 2-in. pipe, so laid that there was not a threaded joint in its entire length, and this equipment was furnished by the Pacific Pipe Co. D. L. Breslauer, the sales manager of this industry, claims that the advantage of used pipe over new pipe is that the former may be had at a greatly reduced price, and that orders may be filled to cover all requirements of new pipe.

PORTABLE MOTOR-DRIVEN COMPRESSOR FOR MINES

The small portable compressor manufactured by the Ingersoll-Rand Co. for mine service, is most valuable, either as an auxiliary to the main compressed-air system, or for development work in mines without compressed-air service. It may be used for operating drills, coal-cutters, air-lifts, and for other purposes. It is mounted on a truck with flanged wheels of a gauge to suit the mine-track, so as to be

moved wherever needed. This type of compressor is made in capacities up to 415 cu. ft. of air per minute and for pressures up to 100 lb. The motor, which is built by the Westinghouse Electric & Mfg. Co., is designed to operate on any available current, and is furnished in sizes ranging from 12 to 56 hp., depending on the capacity of the compressor. A large air-receiver forms a part of the equipment. Into this the air is pumped and the pressure automatically is maintained constant.

SULLIVAN ROTATORS

The Sullivan rotators, 'DP-33' and 'DR-33', made by the Sullivan Machinery Co., may fairly claim to be an all around rock-drilling machine. Since its introduction, a few years ago, as an improved type of hammer-drill, its use has rapidly extended to nearly all kinds of rock-drilling, including block-holing and cutting hitches; shaft-sinking, and a great variety of down-hole drilling, driving, stoping, and even light tunneling; work in hard and soft rock, ore and coal, in quarries and mines, in road grading, in sewer trenches, and in heavy open-cut work. The rotator is a one-man hammer-drill in the fullest sense, weighing 40 lb. It is equipped with automatic steel rotation, is built in separate air and steam types, and may be used as a hand-tool or on a mounting. Rotators drill holes from eight to twelve feet deep, for 1¼-in. powder, and are available in several models, to suit varying conditions.

The standard machine for down-hole drilling is the hollow piston rotator. A jet of live air is discharged through the hole running from end to end of the piston, into the hollow steel, and thus to the bottom of the drill-hole, where it ejects the dust and cuttings, affording a clean rock-surface for the bit to strike. When no difficulty is encountered in cleaning the hole of sludge, as in shallow drilling or in very hard rock, the solid-piston rotator is recommended. For down-holes in damp or sticky ground, the air-tube rotator is superior, as its constant jet of live air, by-passed from the throttle to the rear end of a tube running through the piston and into the drill-steel, serves to clean the hole more effectively than the air-jet of the hollow-piston type.

The steam-tube rotator is similar in design to the air-tube drill, but uses steam instead of air. Its use is not recommended for holes deeper than four or five feet. It is a valuable adjunct to a steam-shovel, for block-holing rock fragments too large for the shovel to handle.

For soft loose or broken rock and for ore or coal, the Sullivan auger rotator is desirable. Its spiral drill-steel acts as a conveyor to keep the hole free from cuttings. With the exception of the steam-drill, any of these rotators may be used on a mounting. For driving and stoping, however, the Sullivan water-tube rotator is recommended. Its combined air and water-jet acts as an effective hole-cleaning device and greatly enhances the speed of drilling holes directed at or near the horizontal.

Students of drilling economics have emphasized the amount of time lost in a shift due to delays for moving mountings, changing drill steel, aligning the steel with the drill and following the hole. The 'Pnufeed' Sullivan mounting affords a means for speeding up the rock-drilling process by eliminating some of these causes of delay and minimizing others, to the end that a far larger proportion of the shift is made available for actually cutting rock. Equipped with this mounting, the rotator becomes almost an automatic rock-drill, suitable for light driving, slicing, or even stoping. It is the lightest driving-drill of its capacity on the market, and requires minimum labor both in operation and in setting up or tearing down. The 'Pnufeed' consists of a feed-cylinder and a piston which carries at its outer end an arm set at right angles, containing a seat in which the rotator is gripped by three clamp-bolts. To fit the rotator for this purpose the throttle valve is removed and the air is admitted to the drill and feed-cylinder by one throttle, placed in the short arm on the piston. The feed cylinder is held by a hinged clamp mounted on a trunnion, which fits a standard saddle, for support on a column arm. When the drift has been drilled up, the clamp-bolts may be loosened, the drill removed, the throttle replaced, when the tool is ready again for use as a hand-feed machine. The 'Pnufeed' rotator may also be used for overhead stoping by removing the feed-cylinder from the arm-clamp and resting its rear end on the ground or against an abutment. While any rotator, except the air-tube and steam-tube patterns, may be used on this mounting, the water-tube drill is recommended, on account of its combined water and air-jet, which secure the best results for cleaning holes in driving work.

CLEAN YOUR SMOKE-STACK

Where there are large smoke or kiln-stacks that become clogged with soot, it is necessary, in order to maintain draft, that they be cleaned frequently. A simple, economical, and efficient method for doing this is to shoot the stack with the 'stack gun' and FFF blasting-powder. This gun can be used in cleaning either lined or unlined stacks, brick or steel, without fear of injury. The gun can be made of an old piece of shafting about 4 in. diameter and 14 to 16 in. long; bore a hole 1¾ in. diameter and 10 in. long in the centre of the piece. Then bore a small horizontal hole ¼ in. diameter through the piece to the bottom of the centre-bore. This serves as a touch-hole for inserting the fuse. It can be mounted on a pedestal about 6 in, diameter so that it will stand upright. The method of operation is as follows. Pour some FFF blasting-powder into the mouth of the cannon to about 2 in. from the top. Tamp to the collar with dry clay. A short piece of fuse is inserted in the touch-hole and in contact with the main powder-charge. Open the flue-door at the bottom of the stack, set the cannon on the bottom, in the centre of the stack, light the fuse, and close the flue-door. The explosion shakes and loosens the soot adhering to the sides, causing it to fall to the bottom. It can then be removed through the flue-opening. A charge of 8 in. of FFF powder, 1¾ in. diameter, is sufficient for a stack 100 ft. high and 4 ft. diameter, or more. The number of shots necessary to thoroughly clean a stack depends upon its condition. Ordinarily three or four will clean a stack, but, if very dirty, it may require more. The size of the charge and length of the cannon can be regulated to suit the height and diameter of the stack.

'Ideal Power' for September tells the story of the reorganization of the Chicago Pneumatic Tool Co., giving the full list of all officials and their portraits, together with those of leading stockholders. Heading the list of large shareholders is Charles M. Schwab, followed by John R. McGinley, chairman of the board; H. A. Jackson, president; W. P. Pressinger, vice-president in charge of sales; W. H. Callan, vice-president in charge of plants; Jacob L. Price, vice-president and treasurer; H. D. Megany, assistant to the president; and J. U. Blanchet, comptroller. The magazine section is timely and interesting. Copies may be obtained gratis from the Chicago Pneumatic Tool Company.

The Merrill Metallurgical Co., 121 Second street, San Francisco, has just issued an interesting and attractive illustrated catalogue describing the Merrill precipitation process, the Crowe vacuum-precipitation process, and 'Merrillite,' which is an effective precipitant.

The Shoshone Sulphur Co., Dover, Delaware, has been incorporated with a capital of $2,500,000 to operate sulphur properties. Charles D. Allee and Harry McDaniel, Dover, are the principal incorporators.

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Camp Tuluferro, Texas	11,542
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Camp Devens, Mass.	87,128
Camp Kearny, Cal.	61,810
Camp Custer, Mich.	9 404
Raritan River Ordnance Depot, N. J.	20,016
Camp Stuart, Va.	41,906
Engineer Depot, France	189,414
Ebbetts Field, Ark.	9,802
Kelley Fields, Texas	94,687
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Camp Funston, Kan.	800,000
Camp Custer, Mich.	400,000
Camp Wadsworth, S. C.	700,000
Camp Wheeler, Ga.	500,000
Camp Cody, N. M.	1,000,000
Camp Sevier, S C.	400,000
Camp Shelby, Miss.	800,000
Camp McArthur, Texas	200,000
Camp Greene, N C.	400,000
Camp Logan, Texas	400,000
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March Field, Cal.	76,000
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Q.M. Dep., E Columbus, Ohio.	400,000
Q.M. Dep. New Cumb., Pa	400,000
Ordnance Depot, Pa.	200,000
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Camp Perry, Ohio	300,000
Aerial Gunnery School, Fla.	200,000
Camp Jones, Ariz.	100,000
Q M. Term., Charleston, S. C.	400,000
Raritan River Ord. Dep., N. J.	50,000
Coast Defense, Pensacola, Fla.	400,000
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Actuate Proving Grounds, Mass.	100,000
Fort Sill, Okla.	1,200,000
Fort Keogh, Mont.	100,000
Q M Storage Depot Mo.	40,000
West Point Artillery Camp, Ky	400,000
Camp Jackson, S. C.	1,600,000
Training Camp, Chemical Warfare Service, N. J.	100,000
Camp Bureaugard, La.	1,000,000
Waller Reed Gen. Hospital, Washington, D C.	400,000
Tank School, Raleigh, N. C.	500,000
Orrana, Va.	400,000
Camp Grant, Ill.	400,000
Jefferson Barracks, Mo.	200,000
Picric Acid Plant, Mich.	100,000
Camp Dix, N J.	400,000
U S. Shipping Board, Va.	200,000
U. S. Shipping Board, Cal.	200,000
Aberdeen Proving Grounds, Md.	148,000
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Filtration Plant	93,500
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EDITORIAL STAFF

T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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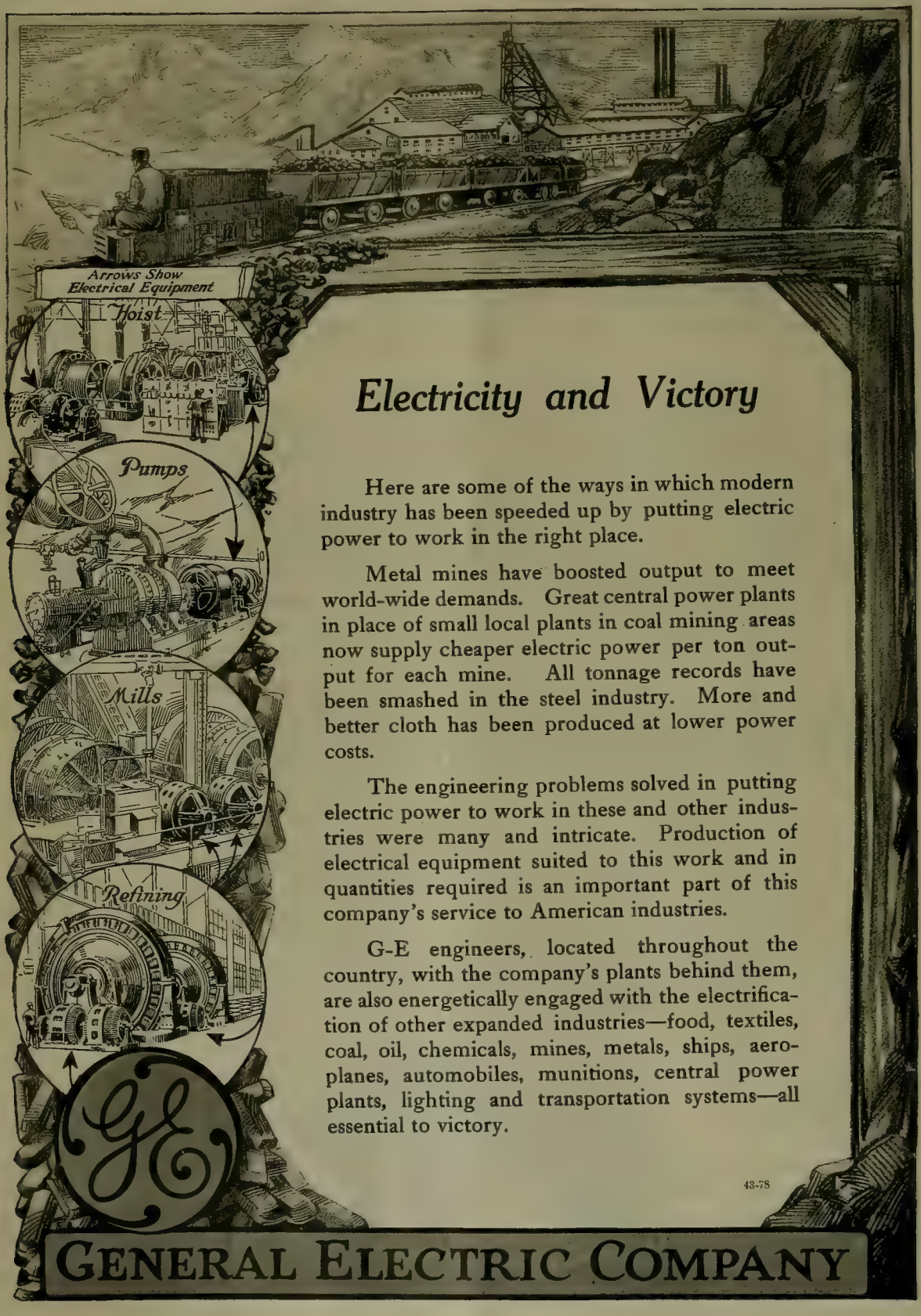


Electricity and Victory

Here are some of the ways in which modern industry has been speeded up by putting electric power to work in the right place.

Metal mines have boosted output to meet world-wide demands. Great central power plants in place of small local plants in coal mining areas now supply cheaper electric power per ton output for each mine. All tonnage records have been smashed in the steel industry. More and better cloth has been produced at lower power costs.

The engineering problems solved in putting electric power to work in these and other industries were many and intricate. Production of electrical equipment suited to this work and in quantities required is an important part of this company's service to American industries.

G-E engineers, located throughout the country, with the company's plants behind them, are also energetically engaged with the electrification of other expanded industries—food, textiles, coal, oil, chemicals, mines, metals, ships, aeroplanes, automobiles, munitions, central power plants, lighting and transportation systems—all essential to victory.

43-78

GENERAL ELECTRIC COMPANY

EDITORIAL

GERMANY'S latest note, signed by the same Secretary of State, is bewildering in its sophistry and prevarication. It protests against the reproach of inhumane actions at the moment when the people of Lille, Douai, and Roubaix are complaining loudly of the brutality to which they have been subjected up to the last minute of the German occupation of these cities; it denies the sinking of life-boats carrying passengers from vessels sunk by submarines at a time when the screams of the unhappy victims from the 'Ticonderoga' and 'Leinster' are still echoing around the world; it talks of such a change in the constutition of Germany as to ensure popular representation "based on equal, universal, secret, and direct franchise," yet we have no evidence that there has been either a revolution or a general election in the Kaiser's domain, and without one or both of these no such change is possible. The same Secretary of State, appointed by the Kaiser himself, is conducting this sparring for time, while the Germans are making an effective retreat to prepared positions in their rear. The advance of the Allied armies has been rapid, but there is nothing to indicate that the German armies are routed; on the contrary, they are moving backward without incurring heavy loss, they are not being destroyed, and if an armistice be granted they will remain formidable instruments for evil. The prisoners captured during the last ten days have been relatively few; so also the guns that the Enemy has lost; he is making a successful retreat, withdrawing rapidly over Belgium while pivoting firmly in the Ardennes, where our boys are fighting splendidly. He talks of 'honor' when he means 'advantage'; he is an outlaw not to be trusted; the less said to him the better; he invoked the arbitrament of force, and understands no other argument.

CONDITIONS in Mexico are reported to be improving steadily. The Mexican is an agile climber of fences and is becoming more amiable to Americans sojourning in his country now that the United States has developed imposing military resources. German propagandists are losing ground and are causing less trouble to American enterprise.

LAST year there was a plan afoot to organize a corps of American engineers to go to France for the purpose of assisting in the rehabilitation of the coal mines near Lens, Douai, and Cambrai; but the subsequent setback in the Allied offensive halted further action. Now the Germans are being driven from this coalfield and an effort is sure to be made to re-open the pits as quickly as possible. Unfortunately in the interval the Germans have done a great deal of damage not only to the equipment but to the mines themselves. A dispatch appearing in the daily press mentions five years as the time needed to render these mines productive again, but with intensive effort and co-operation it should not take so long. The Valenciennes coalfield, of which the Marles, Lens, and Douai districts constitute the south-western end, covers three-quarters of the coal resources of France.

IN a recent issue we referred to the fact that the 'featuring' of the Australian and Canadian performances at the front had misled many people and given material for pro-German propaganda in this country, and we imputed it to the British admiration for the loyalty and courage of their brethren from across the seas. A British officer informed us this week that there was another reason for the frequent mention of the Colonial troops, namely, that if British regiments were mentioned specifically the information was useful to the Enemy, whereas the mention in general terms of 'Australians' or 'Canadians' did not convey intelligence to the other side. Thus, if in an engagement, the West Kents and the Buffs happened to be engaged and were supported splendidly by a regiment of Canadians, it was more expedient to talk about the latter than to refer to the two English regiments, for that would enable the German command to identify the division, giving valuable information, such as is sought usually by means of trench-raids, leading to the capture of units and identification of their division to which they belong. Mr. Hearst, please copy.

AT a meeting of a large number of the producers of chrome ore, held in San Francisco last week, a permanent protective organization was formed, under the name of the Pacific Coast Chrome Producers Association. This is an excellent step. Through this organization the excited protestation of individuals who have been induced to enter into an industry that has entailed loss and discouragement will be replaced by such a temperate presentation of the circumstances as must command

respect at Washington. The producers of chrome have a real grievance, and it is of a kind that wins public sympathy. Before the War there was no interest in chrome mining in this country, because large deposits, which could be cheaply worked, had been developed in New Caledonia, Rhodesia, and other countries. When, however, our entry into the War made it imperative to use ships for military purposes, the Government instantly asked the Geological Survey and the Bureau of Mines whether a number of essential minerals, which previously had been supplied from abroad, could not be produced in sufficient quantity here to meet the requirements of the makers of munitions. The answer was affirmative concerning chrome, manganese, pyrite, and various other minerals. Accordingly an appeal was made to the people, in the name of patriotism, to prospect for these essential materials; to hasten their production; and to arrange through the appropriate committees at Washington for their distribution to the consumers. It was suggested, as a matter of course, that the price also would be fixed officially. In the case of chrome ore after a time a basic price was established through a subsidiary company established in San Francisco by the leading consumer. To this the objection might be offered that it would have been a more regular procedure to have done it through the proper committee of the War Industries Board or at least by an agency not suspect of turning the opportunity to its own advantage. The fact that disaster has followed, that the chrome producers generally have been left without a remunerative market, and indeed with no demand beyond that already covered by contracts, lends point to the criticism of the manner in which the business was handled for the Government. It cannot be the intention of the Administration to urge men to enter into new and untried ventures for the sake of supplying the Nation's need in War and then to leave them financially ruined; it is such a plain case of moral responsibility that but one answer can be given: these men must be provided with an outlet for their ore at prices that will avert loss. By means of an organization it will be possible to collect such definite information as will enable the officials to adjust measures for relief. The chairman of the Association is Mr. C. H. Holbrook of San Francisco.

HEARTY thanks from the public are due to the New York 'Tribune,' which has been conducting a vigorous and effective campaign against Hearst and his reptile press. The 'Tribune' is Republican and Hearst, unfortunately for his party, is Democratic, but we assume confidently that the attack by the 'Tribune' is not made for political but patriotic reasons, otherwise we would not commend it so unreservedly. It is true, Hearst caused placards purporting to be an official condemnation of the 'Tribune' to be posted in post-offices and railroad stations, but the Post-Office Department, on September 26, issued a notice to postmasters ordering them to remove such posters from their offices. The forces of commercial graft and press prostitution have combined to fight the 'Tribune' in New York. When that great newspaper began its exposure of Hearst's devious ways, the newsdealers joined in the fight, refusing to sell the Hearst publications, of which there is an intolerable number, as our readers are aware. Thereupon the members of the New York Publishers' Association, except the 'Tribune,' decided to treat the action of the newsdealers as an illegal boycott. This meant that any newsdealer that refused to sell Hearst's 'American' or 'Journal,' or reduced his daily orders for them, could buy no other morning or evening paper. Evidently the Publishers Association feared the exercise of such discrimination by the newsdealers, because it might be used against any one of them and it might lead to a demand for a general reduction in the price of papers; in short, the publishers feared a trespass upon their power. This compelled the 'Tribune' to announce that it would sell its papers through all newsdealers alike, whether they handled the Hearst papers or not. To this the Publishers Association replied by commanding that the circulation of the 'Tribune' be restrained; it notified the American News Company not to deliver the 'Tribune' to anti-Hearst newsdealers. The News Company, which enjoys absolute control of the distribution of morning papers in New York, refused to deliver the 'Tribune' to newsdealers that had either cancelled or reduced their orders for the Hearst papers. At this point the 'Tribune' had to decide either to compromise or lose control of its own circulation. It chose to continue the unequal fight. First it met the newsdealers' economic difficulty by decreasing the price of its paper from $1.40 to $1.20 per hundred. Immediately the News Company refused to deliver the 'Tribune' to any newsdealer except at the old price. Not content with dictating to whom the 'Tribune' should be sold, the News Company decreed the price at which that splendidly belligerent paper should be sold. To this the 'Tribune' replied by organizing its own delivery system, a most costly operation. The Tammany administration of New York revoked the licenses of the anti-Hearst newsdealers, whereupon injunction proceedings and incipient riots ensued. The good fight proceeds. We give an account of these events in order to arouse public support in behalf of the 'Tribune,' to which we extend our compliments and best wishes. *Delenda est Hearstiana!*

Vive la Belgique!

Men love to personify a cause; to us the Kaiser epitomizes Prussian aggression; to the German our President stands as the symbol of American purpose. There is another that emerges as the standard-bearer of a gallant people; to King Albert of Belgium the civilized world turns today with a glad smile of hearty congratulation. During a period when many kings and emperors have gone into the discard it is remarkable how the democracies have given the homage of their respect to the titular chief of the Belgians. He has shown himself a constitutional monarch, not a Hohenzollern nor a Hapsburg, and like the kings of a more romantic era he

has not hesitated to take his place at the front of battle among his own soldiers. It seems long ago since that black hour when Germany called upon Belgium to allow the gray swarm of invaders to pass through on their way to France, and Belgium, refusing to be a road, asserted herself a nation. At the critical moment, on August 4, 1914, King Albert, addressing the Belgian parliament, said: "I have faith in our destiny. A country that defends itself gains the respect of all. God will be with us in this just cause." The German horde drove the Belgian army to the farthest corner, but not out of Belgium; they passed over the country, devouring and devastating; it looked as if Belgium were to be crushed utterly. It was then that the indomitable spirit of the king fired his people with the resolve not to submit. The Kaiser, looking with a sneer at his victim, might be supposed to say: "So, you see, you've lost everything." To which King Albert replies: "Not my soul." He preserved his unconquerable soul in patience and in resolution until the tide of battle should turn and the embattled democracies should have time to prepare themselves to drive the barbarian back and re-assert international law. Four years of bitter suffering for his people and four years of courageous fighting for him and his army had to pass before the king could flash his sword joyously and lead the return homeward. The triumphal march of that little army, supported by the hosts of the Allies, expresses the resurrection of Belgium from the tears and the ashes of a fearful calamity; it symbolizes the true meaning of the tremendous conflict that has raged for these long years; it is an augury of the complete vindication of the rights of the small nations as against the callous violation of their independence by the arrogant militaristic powers of feudal Europe. In Serbia likewise the tide has turned; the despoilers are being driven northward and the remnant of the native army, still full of fight and tenacious to the end, is marching to victory, conscious that at last they are regaining their hearths and homes for good. To King Peter and to King Albert *nos salutations les plus sincères!*

Inflation and Credits

It is a pleasure to present so cogent an analysis of the meaning of inflation, and of the relation that gold production bears to the country's finances, as that contained in the excerpt from the October bulletin of the National City Bank, printed in our last issue. It is not a statement of remedies; it is a piece of surgery, laying bare the peril threatening our existing credits, which have been developed at the call of extraordinary production and exorbitant prices. The resulting obligations cannot be liquidated at their face-value except there be an adequate supply of gold. To have such a supply necessitates an uninterrupted output at maximum capacity. In the inevitable re-adjustment of 'values'—we think 'prices' would have been the better term—after Government orders have ceased, the one sure way to prevent the accumulated obligations from shrinking, through inability to collect their full value, is to prolong the period of liquidation. That necessitates the enlargement of credits to cover old transactions as well as to sustain the active commercial movement of the period. It involves an increase in the burden that the banks must carry. The economists of the National City Bank recognize that something is needed to prevent collapse, and, as representatives of an institution that has offered wider facilities of finance to the budding enterprises of Brazil, of the Argentine, and of far-away China and India, to say nothing of the great services performed in the busy marts of the United States, they properly take the position of the cheerful optimist. They predict a great industrial boom after the War; many others have prophesied the same. They refer to the volume of "waiting orders" that will "sustain prices or moderate their decline." We are fully as optimistic as they; perhaps we are all catching the optimism of the indomitable French; but we realize, too, how important it proved in the history of civilization that France, in time of peace, had made ready for war. In finance, as well, we must sustain our optimism by readiness for the opposing tide. When business grows dull, when men become fearful of the stability of demand and begin to slacken their productive effort, when contraction becomes the order of the day, and initiative slumbers, then the airy castles of bonanza times come crashing down, leaving distress and suffering in their wake—unless the sound basis of finance, namely, gold in sufficient quantity to pay every commercial doubter and every timid depositor, is ready at hand, and available as security for additional advances of credit. The amount of gold in the world today, in comparison with the total volume of trade, is but a fraction of that which served mankind in the days when the gold mines of California and Australia disturbed the economic structure and gave new point to the 'quantity of money' theory. There is no such superabundant quantity of gold today. It is all a matter of relative proportions. We need more than we have in order to put us back on a level with our financial position even of 18 years ago. We have not tested the ultimate security of our credit structure, and it is to be hoped that we may not need to do so. We must never forget, however, that it rests on gold, and that the foundation has not been widened in the same ratio as the size of the financial obligations, both ours and those of our Allies, that it is required to sustain. The American Bankers Association cited Secretary McAdoo as authority for recognizing the undiminished output of new gold as one of the most urgent war-essentials. Their acceptance of his statement will strengthen the Administration in its purpose to aid the industry as a national necessity. In addition to the statement made in the October bulletin, above mentioned, the National City Bank, in its monthly magazine entitled 'The Americas', takes the same position regarding the need of more gold after the War as that so clearly stated by the 'Commercial and Financial Chronicle', to which we referred on October 12. The argument appears on another page of this issue: "Interruption of the normal production of

gold, which would affect the supply for a term of years, would * * * intensify the reaction from the present period of inflation, when it comes." It will be observed that the managers of the National City Bank, despite their confidence in a period of great industrial activity after the War, express no doubt as to the reaction from the credit-inflation that war has engendered. They do not assume that normal business will maintain the same degree of exaggerated banking accommodation that is permitted today. These credits have been necessary to facilitate the military enterprise of the Nation, but, after all, they are not based on imaginary services; they represent the current needs of material for making the implements of war at a time when the active buying of the Government has been the chief contributing cause of high prices. Debits and credits are the warp and woof of the fabric of commerce; the relation of one to the other must be sustained or the fabric becomes but a tangled skein. Continued credits, covering past obligations, must be extended for a considerable period after the returns to the manufacturer or merchant have become reduced because of the falling prices, in order to avert catastrophe. The whole world cannot liquidate at once out of reduced receipts; the time of settlement must be lengthened, and it must be so done that public confidence be not impaired. Confidence will be sustained so long as the banks carry what the business world has ascertained to be a safe proportion of gold to guarantee outstanding obligations. We publish this week an illuminating statistical presentation of this subject by Mr. H. N. Lawrie. From this will be seen the relation between trade balances and the gold movement, together with the bearing of these upon our present stock of the monetary metal; at the same time Mr. Lawrie shows the extent to which the gold-reserve has been utilized as a basis for governmental credits. This is approximately 1:12, without taking into consideration the commercial credits extended by the banks. We believe that the expansion in these alone will prove to exceed the ratio of 1:20. It is the problem of pulling this balloon back close enough to the solid earth for the reasonable safety of the passengers in the business-basket that concerns the financiers. The National City Bank says that the best way to tide over the difficulty of the gold miners, so as to maintain a steady flow of metal to the Treasury, is to pay a bounty.

Platinum

Lethargy has characterized the administration of the platinum industry by the War Industries Board and it seems not to have been overcome. Efforts antagonistic to the effective exercise of its authority are still being made. No more than two weeks ago dispatches emanating from interested parties at Washington have encouraged the delusion that some new catalyzer had been found capable of replacing platinum in the manufacture of sulphuric acid. Leading producers of that chemical deny that such a catalyzer has been perfected. Energetic research has been made to find a satisfactory substitute for platinum and some advance has been scored, but the goal has not been reached. Mr. C. H. MacDowell, of the War Industries Board, recently informed Mr. Charles H. Herty that experiments conducted under his direction had been "so promising that appropriations had been made for extending the investigation on a larger scale," and he was "rather hopeful of success." Also, Mr. F. G. Breyer, of the New Jersey Zinc Company, who has been pursuing similar studies, stated that "some progress has been made, but it will require three or four years of intensive research by the best men in the country to bring about a successful solution of this problem." The War Industries Board evidently is basing its expectations of immediate relief upon the voluntary surrender of platinum jewelry, and upon limiting the use of platinum for any purpose in the arts under a system of licenses. Meanwhile the sale of platinum jewelry now held in retail stocks has not been interdicted. The remedy proposed is inadequate. The figures presented by the Bureau of Mines show that, whereas platinum has been provided for plants having a total capacity of 2,200,000 tons of concentrated sulphuric acid, the new plants and the extensions of old ones, designed to meet our immediate requirements in the manufacture of munitions, demand platinum sufficient for an additional 800,000 tons of acid per annum. This is quite apart from the needs of the nitric-acid makers. In the production of tri-nitro-toluol ordinary chamber sulphuric acid will not serve nor can it be concentrated to the proper strength. Nothing but the fuming sulphuric will yield a stable quality of T. N. T., and this grade of acid can be produced only by the contact process, that is, by aid of platinum. The Government is short one million tons of fuming acid required for making the explosives needed during the remainder of the current year at the existing rate of consumption. To complete the new acid plants now authorized 32,000 ounces of platinum would have to be used in the catalyzers. In March the Government estimated that it needed 40,000; the exigencies of the War have so increased the demand that a revised estimate, made in June, placed the requirements at 69,000 ounces. The total output of new platinum in the world for 1917 was only 83,000 ounces, and a considerable proportion of that had to go to our Allies. It will be evident, therefore, that the War Industries Board is trifling with the interests of the Nation in pursuing a tender policy toward those who employ the metal for non-essential purposes. The necessary amount cannot be obtained without calling for a surrender of the objects of art, of which an abundance exists in the country; but the public is aware of the deference shown in this matter to the commercial interests. As long as it is possible to buy platinum jewelry in a store it is preposterous to suppose that the people can be impressed with the necessity of making personal contributions. No sentiment attaches to jewelry in the hands of a dealer, but for the individual it may be interwoven with loving remembrances, making it painful to surrender. Nevertheless a generous response at first met the Government's plea. Now, it is plain, the officials must invade anew the temple of Mammon if they are to expect sacrifices on a more sacred altar.

THIS LOOKS LIKE A LANDSLIDE, BUT IT IS A TRAIN OF CLARK CARS UNLOADING CAP-ROCK ON THE DUMP

The Utah Copper Enterprise—IV

The Mine (Continued)

By T. A. RICKARD

The mixture of races is noteworthy. Seven hundred laborers are employed on the railroad and dumps. I have mentioned the Greeks, Italians, and Albanians; to these, Japanese, Koreans, and even Armenians must be added. The various races are segregated into separate gangs, supervised by a foreman of their own kind, able to speak English, which most of the rank and file cannot do. The better tasks, such as switch-tending, flagging, and bossing are given to those that can speak English, most of these being paid 25 cents and some 85c. per day additional. The regular pay of a laborer is $3.40.[13] The men working underground are mostly Austrians and Mexicans, the latter preferring to call themselves 'Spanish' since our trouble with Mexico. For a similar reason the Austrians usually call themselves 'Serbian', since most of them come not from Austria proper but from Croatia and Dalmatia. The Dalmatians and Croatians that belong to the Greek Catholic church call themselves 'Serbians', whereas the Roman Catholics from the same provinces call themselves 'Austrians'. Greeks, Italians, and Finns also are employed underground. The Austrians and Italians talk about 'going home' after the War. Most of them have left their families in Europe. They complain that the Americans do not take them in, they feel backward in making friendly overtures, the result being that they continue alien and form local colonies of their own.

The use of coal by the steam-shovels and railroad-engines calls for remark. The coal comes from the Black Hawk and other mines of the United States Fuel Co. at Hiawatha, and also from the Kenilworth mines of the Independent Coal & Coke Co., all of which are in Carbon county, Utah, and about 130 miles by rail from Bingham. The cheapness of the coal explains the use of solid fuel instead of electricity. When the electric shovel has been more nearly perfected and other conditions are favorable, it is anticipated that the present coal-fired shovels will

[13]Increased on July 1 to $3.90. The foreign gang-bosses now receive $4.15 per day.

be supplanted. The frequent shifting of tracks and the danger from blasting are held to be unfavorable to electric connections.

After luncheon Mr. Carnahan and I mounted an ore-train and switch-backed along the line from the F level to the K level. These switchbacks have a 4% grade, compensated for curvature on the basis of 0.04 ft. per degree of curve. I noted a dozen Japanese engaged in laying track; I also saw the copper-precipitating plant in the Apex Yard gulch, and the old incline-tramway that served to take the ore from the bins at the mouth of the main haulage-level to the terminal beside the railroad. The abandoned rails and other scrap-iron seemed to invite use, either in a foundry or in a leaching-vat; indeed, I was informed later that this material is collected periodically and such of it as can be used to advantage at the foundry is shipped thither, while the inferior scrap, not saleable or suitable for the foundry, is used as a precipitant at the leaching-plant. I obtained a glimpse of the little settlement tributary to the Utah Apex mine, in which lead ore is being won from the limestone. This mine was being threatened by an apex suit to be brought by its neighbor the Utah Consolidated, as I guessed by the recent inspections made by Messrs. H. V. Winchell and A. C. Lawson, both notable experts in such semi-scientific contests. In this part of the district the fissuring of the limestone has formed lenses of ore containing lead and copper, the latter being the first to 'peter out' in depth. Three years ago the Utah Apex mine was the scene of a story worthy of a moving-picture performance.

On November 21, 1913, Rafael Lopez, a Mexican, shot and killed another Mexican named Juan Valdez while they were on their way to the Highland Boy mine. The two actors in this melodrama had been neighbors in southern Arizona; later, in Mexico, the brother of Lopez had won a girl that Valdez desired; the disappointed lover had revenged himself by killing the successful suitor, burning his body. Rafael Lopez was informed of the deed and waited his chance to get even.

After various wanderings in the mining districts of the South-West Lopez came to Bingham at the time of the strike in 1912. He was one of a number of 'strike-breakers' brought thither to settle an industrial quarrel in a crude way. He met Valdez, but pretended to be ignorant of the circumstances of his brother's murder, until, at last, getting into a political argument with Valdez and another Mexican on the road to the mine, he turned on the latter, whereupon Valdez interfered, drew a knife, and was shot promptly by Lopez. Having done so, he turned back, went to his house in the upper gulch, got his rifle and cartridges, and left town.

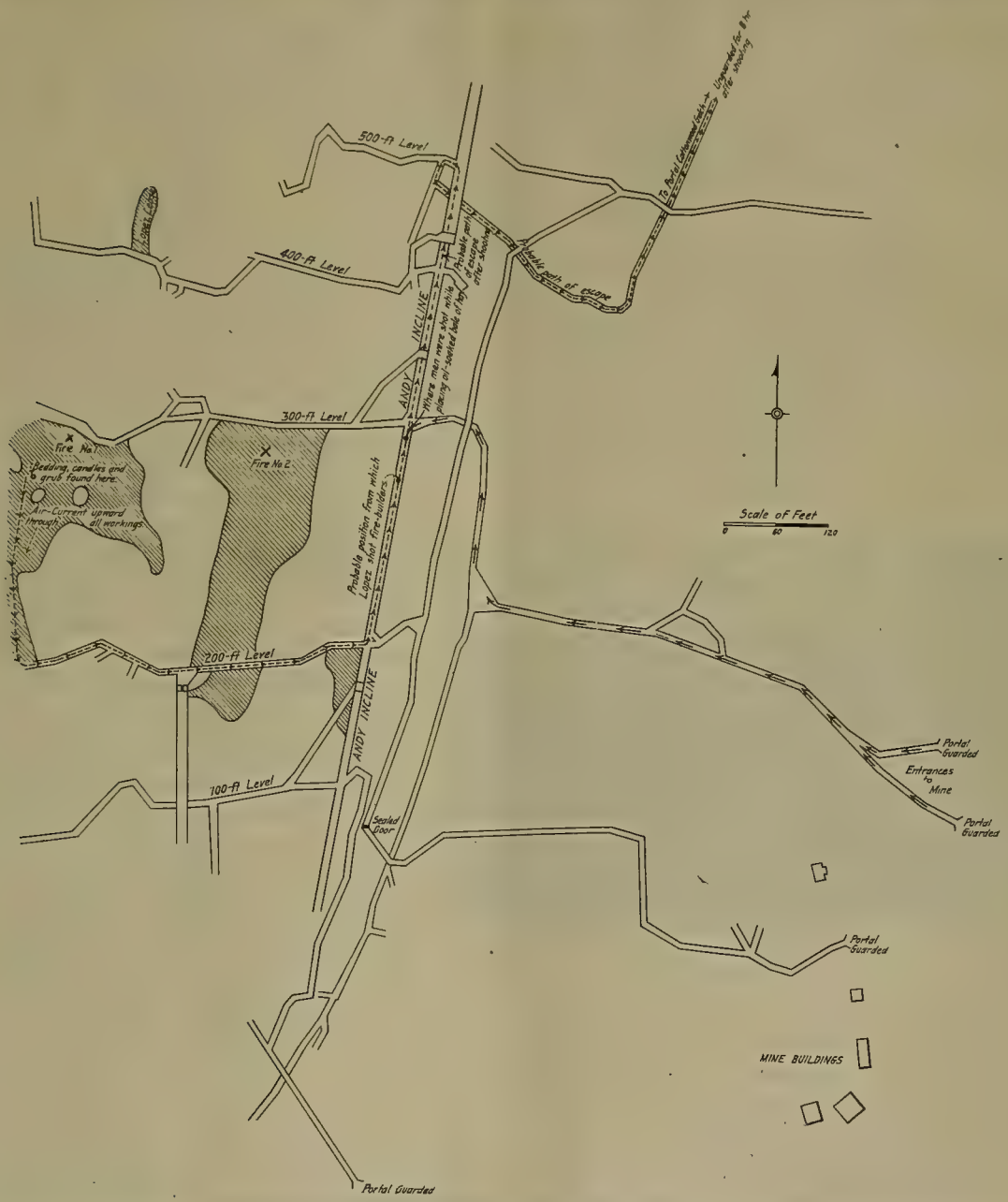
Another story is that Lopez was in love with a Spanish girl, called Inez Ocaro (or Ocarriz) living at Bingham, and that he had bought a box of candy to present to her when, on arrival at her home, he found Valdez there. He waited for his rival to come out and then shot him. The first story is the more probable.

Before this event Lopez was known locally as a good-natured fellow, honest in his dealings, and successful in his operations as a lessee in the Apex mine, where he had made $10 to $20 per day. He had been educated in Texas, his mother being English and his father Spanish. He knew that, as he was a 'Mexican', the officers of the law would give him short shrift, so he prepared to resist capture. Moreover, a few months previously, coming to the aid of two girls that were being molested by a couple of Greeks, he had knocked them down, but his part in the affray had been misconstrued by the deputy-sheriff, Julius Sorenson, and he had been sent to jail. This had embittered him against the officers of the law.

As soon as it became known that he had killed Valdez, the officers went to his house and followed his tracks in the snow across country about 40 miles from Bingham to a ranch near Utah Lake owned by a man named Jones. The four officers were searching for him when he opened fire, killing three of them, but missing Sorenson owing to a defective cartridge. The news soon spread and caused intense excitement. Posses were organized and hurried to the scene of the tragedy, where the Sheriff, Andrew J. Smith, took command of the man-hunt. All sorts of wild rumors spread. Meanwhile the leading posse followed the outlaw's trail into the rugged mountains above the lake. Suddenly a shot rang out and the bullet struck a rock close to the pursuers. The posse sought cover and remained in hiding until evening, returning to quarters for the night. Next day, reinforced and led by the Sheriff, they surrounded the spot where Lopez had halted them, but found only a few empty pistol-cartridges. His poor aim was explained by the fact that he had used his revolver instead of his rifle. A day or two later, on November 26, Lopez returned to Bingham at night, going to the house of a friend, Mike Stefano, who lived in one of the Utah Apex company's houses, close to the No. 2 Tunnel on the Minnie claim. His feet had been frost-bitten and he was lame. He took Stefano's rifle and 40 rounds of ammunition; he also asked for some clothes, a couple of quilts, bread and meat, and made Stefano carry the provisions to the entrance of the Minnie workings. Stefano reported these facts to Tom Hoskins, the foreman of the mine. Immediately the officers of the law were notified and guards were placed at the openings of the mine and in the various workings. The bandit was trapped; but he had miles of workings in which to hide. He was familiar with these workings, for he had been 'leasing' on the 400-ft. level, near the shaft, for several months. He could find his way in the dark. To search for an outlaw at bay in the darkness of a mine was foolish, so it was suggested that he be smoked out, although Mr. V. S. Rood, the superintendent, expressed his opinion that the extent of the workings—20 to 25 miles in aggregate length—would nullify the attempt. A dash was made by 15 men in a steel-protected ore-car, but they found no trace. Lopez 'held up' several miners underground, without hurting them, only taking their candles. The deputies were quite unable to track him to his lair. Intense curiosity prevailed. The whole of Utah was aroused. Everybody had his own idea how to catch

the desperado, without undertaking to perform the feat. He was known to be a remarkably good hip-shot, that is, he could shoot accurately without sighting.

The Sheriff ordered the superintendent of the mine to cease work on the upper levels, but the miners had been lights were placed so as to illumine the surface. Fresh fires were about to be started. Four men climbed with a bale of hay up an incline, called the Andy; two were pulling and two were pushing the bale over a pile of waste at the bottom of a big stope when suddenly three



THE MINE-WORKINGS IN WHICH LOPEZ SECRETED HIMSELF. THE ARROWS ON THE LEFT SHOW HIS PROBABLE TRAIL; THOSE ON THE RIGHT INDICATE THE MOVEMENTS OF THE POSSE

scared and operations had been half-hearted since the affair began. At last, unable to track the desperado, it was decided to try smoke. The guards were doubled, some of the outlets of the mine were sealed, others were watched with increased vigilance, and powerful search-

shots broke the silence of the mine. One man was killed at once and his body rolled down the incline; another fell and crawled aside, groaning horribly. The remainder of the posse tried to recover the bodies of their comrades, whereupon Lopez came down the slope, so as to see better,

and opened fire again, without causing further casualties. The deputies escaped to daylight. This was on November 30. The next day the Sheriff conferred with Mr. Rood, the superintendent, and Tom Hoskins, the foreman; the result being a decision to bulk-head the levels and fumigate the whole of the upper workings until every part was saturated with gas. They could ascertain when the oxygen in the air of the mine had been consumed by the fact that the fires would refuse to burn further. Among the combustibles used, or suggested, were formaldehyde, potassium permanganate, lump sulphur, green wood, damp gunpowder, oil-soaked cotton-waste, and cayenne pepper. The fires were kept alight for five days. It cost the Utah Apex company several thousand dollars and threw 200 miners out of work for 10 days.

By this time public excitement had reached a climax. The Governor offered a reward of $1000 for the capture of Lopez. The newspapers made the most of the man-hunt. During intervals the daily press gave full space to describing the funerals of the victims of the chase. Betting was lively. When the bulkheads were removed, on December 5, and search for the supposed dead body of Lopez was begun the next day, it became evident that the local betting was lending a gruesome zest to the examination of the mine. Many felt sure that he had escaped; he was reported as seen at several localities; one person acknowledged to having received a letter from him post-marked Salt Lake City. On December 10 the girl Inez Ocarriz stated that she had talked with Lopez in the Andy tunnel; three days later a shift-boss claimed to have been accosted by him underground and he had sworn to die fighting. The officers did not abate their watchfulness, relying upon starvation to finish the pursuit. Stefano's blankets and other traces of Lopez were found in the fifth stope of the Andy incline. Another stope, in which he was imagined to be, was dynamited by the Sheriff, after a melodramatic call to the desperado to surrender. Nothing came of it. Those who saw the dense clouds of smoke that issued from the mine-openings when the bulkheads were removed decided that no human could have survived the effect of them. Days passed; the mine was ransacked from end to end, public interest waned, several guards resigned, and the Sheriff had to bring the fiasco to an impotent conclusion. I am told that there was dispute as to how the desperado managed to get food while in the mine, the most likely suggestion being that "he lived on the milk he got from the Sheriff's goat." Lopez was never seen again. His fate remains unknown. It is probable that he escaped during the confusion and delay following the shooting underground, for 24 hours elapsed before the workings were sealed.[14] Perhaps he became a *revoltoso* in Mexico and under a new name now plays the part of a constitutional reformer south of the Rio Grande.[15]

Returning to the Utah Copper, the block-signal system is not in use on the mine-railway. No less than 120 men are employed as switch-tenders. This will afford suitable employment for crippled soldiers returning from the War.

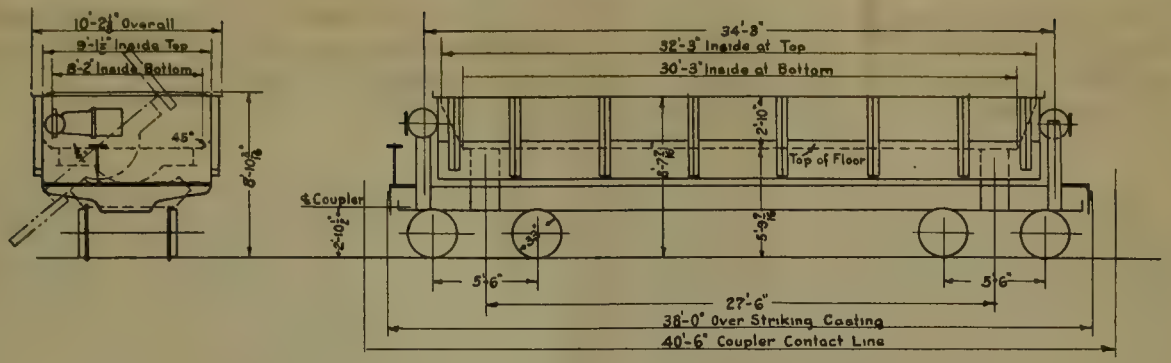
From the K level I obtained a new view of the surficial workings. We walked along this terrace, which curves south-eastward, to the far end, where I noted the disposal of waste removed in the course of 'stripping'. Here, in Galena gulch, 8,000,000 cubic yards of rock has been stored, leaving room for 15,000,000 more. The waste discarded in the past has been about equal to the ore won, but in the future the proportion of waste to ore will decrease gradually. Last year 4,271,868 cu. yd., or 8,827,400 tons, of cap was set aside while 6,038,900 cu. yd., or 12,542,000 tons, of ore was sent to the mills. The cap-rock of carbonate ore is kept separate by removal over a railroad that crosses Bingham gulch and passes along the east hill to Tiewaukee, McGuire, and Little Eddy gulches, where 20,000,000 tons of it, containing 0.65% copper, is stored until it can be treated at the leaching-plant in the Salt Lake valley. Below the dump of brown monzonite is another consisting of quartzite, from the edges of the orebody. This contains only 0.3% copper.

Turning round, so as to face south, toward the dumps of 'stripping', I noticed groups of men on each of the L and M levels. These were gangs of 12 to 20 laborers, engaged in dumping cars, moving track, and shoveling rock. Three kinds of cars are in use: the Clark automatic car, of 30 cu. yd. capacity; the Oliver, of 12 cu. yd. capacity, dumped by hand; and the crab-cars, of 6 and 4 cu. yd. capacity, these last being confined to the three uppermost levels. The inferior cars are being replaced gradually by the superior, the poorer type going up-hill. Crab-cars are used only on the two uppermost levels. As an example of the foresight of the Utah Copper management I mention the fact that the south end of the property was tested with churn-drills before it was covered with waste, thus avoiding the blunder, made in other districts, where 'stripping' has been spread on ground that subsequently proved ore-bearing and suitable for steam-shoveling. The surface of Galena gulch covers the workings of many notable mines, such as the Jordan, Telegraph, Spanish, and Galena, which have yielded many million dollars in lead and silver. Looking across, over the wastage from the big mine at my back, I noted the excavations in the underlying limestone. It was a quiet spot, detached from the intense activity of the mining operations; the tender green of the spring foliage nearly covered the old scars made by the miner; from the farther hillside came the sound of cow-bells, and from the long grass a meadow-lark carolled rapturously.

It would be pleasant to leave Bingham with the song of the lark in our ears, but a respect for the realities compels me to confess that, my visit being concluded, I walked down the gulch from the mine-office to the rail-

[14]Mr. Rood, in a recent letter to me, says: "Lopez had access to the seven levels on the incline, as well as all the workings in the old York, Petro, and Phoenix mines. If he had desired, he could have held-up the hoisting-engineer on the 700-ft. level and taken a chance to reach the lower levels by climbing down the main shaft."

[15]For my information I am indebted to the files of the 'Deseret News' and to a pamphlet, by one of the hoist-engineers at the Utah Apex mine, entitled 'Utah's Greatest Man-Hunt; by an Eye-Witness'.



THE CLARK 30-YARD STEEL DUMP-CAR

road-station, and on my way passed through the settlement of Upper Bingham. The road is the main street and under it is the flume to which the creek is confined. On each side are dilapidated houses, interspersed with cheap-looking cinema-halls, abandoned saloons, in some of which 'soft drinks' are sold, and bedraggled stores, with windows in which gaudy apparel is displayed. The smell of Cairo and whiffs from the Levant are confirmed by the tongues of south-eastern Europe, by Greek and Italian and undistinguishable dialects. It is a *cloaca gentium,* an unromantic and unlovely reminder of an un-Americanized community.

Such herding of un-assimilated fragments of Europe is opposed to the nation-making process. Filth and ignorance must be removed if we are to develop a healthy democracy. Upper Bingham is a warning to the American patriot. It is symptomatic of our Western mining districts and of our Eastern industrial centres. The mere fact that hundreds of men employed at a mine speak only foreign tongues, and make no effort to learn the language of this country, is a menace to our national development; and if to this linguistic isolation is added unsanitary ways of living, how may we expect to produce good citizens? To produce large quantities of copper cheaply is a useful achievement, but the making of good citizens is a process even more enriching to the United States of North America.

This may seem to be no part of my subject, but I mention it as one of the many impressions left by my visit to the great mine. The Utah Copper Company has tried, several times, to purchase the ground on which the settlement of Upper Bingham is situated, but such unreasonable prices have been asked that no purchase was practicable and no betterments have been possible. Most of the men living there are the employees of neighboring companies. The few employees of the Utah Copper, and single men only, that live in Upper Bingham are in boarding-houses operated by lessees. I am glad to add that the Company is subscribing to an institution at Bingham that has established classes for teaching foreigners the English language and American ideals. This shows that public sentiment has been awakened to the urgent need of Americanizing the alien elements that constitute so large a part of our population.

At Garfield, between the mills and the smelter, the Utah Copper company has built 750 houses that are leased at low rentals to employees and form an attractive settlement. Everything of this kind is a step in the right direction. Industrial enterprises have obligations as well as privileges, and it is a sign of the times that those in control recognize their responsibilities, not merely as engineers, but as good citizens in a democracy.

THE ENTRANCE TO THE MINNIE WORKINGS OF THE UTAH APEX MINE

Taking the train for the return journey, I asked a fellow-passenger about the Japanese. He said they were "right up to the mark on Red Cross and Liberty Bonds." At Magna the mill-hands boarded the train and I found myself in the crowd with which I had come out in the morning. While the train halted, I noticed a stalwart young fellow, a brakeman, shaking hands with several friends in farewell. He had been drafted and was off to the War. It seemed a far cry from that wayside station overlooking the Great Salt Lake to 'somewhere in France,' but the copper that I had seen being mined at Bingham had the same destination, and was to be used for the same purpose, the greatest purpose in the world just now: to stop the march of the goose-step over creation, to frustrate the designs of the Prussian outlaw, and re-establish good faith among the nations.

The Zeebrugge Affair

[Herewith we publish an account of the gallant manner in which the harbor at Zeebrugge, a German submarine base, was blocked last April. The story is told by one of the officers participating in this heroic enterprise. We have added a map, so that the description can be followed easily. It is rendered more interesting by the actual capture of Zeebrugge.—EDITOR.]

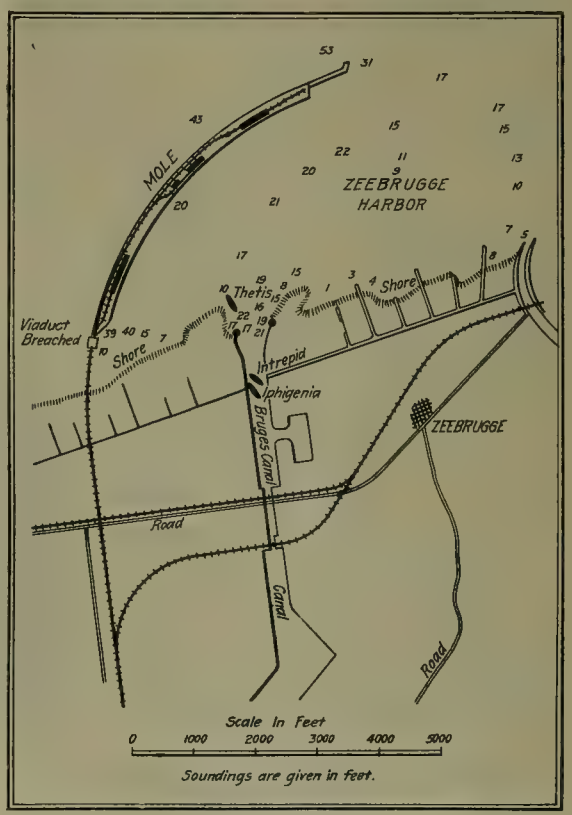
The problem that lay before us was far bigger and greater than the landing on the mole, or any mere spectacular features. It was vastly different from merely sending one or more ships into a harbor protected by shore-batteries, because the channel to be blocked was narrow and a ship or ships must be placed carefully to make the effort successful. Moreover, the waters through which the vessels must dash were under the protection of heavy guns, which commanded the sea practically for 15 miles out from the coast.

This meant that the vessels, with the blocking-ships, must arrange their dash under cover for 15 miles; and then, having run the coast-batteries, they must go close to a heavy battery upon the mole, located about a mile out in the harbor, and able to fire practically point-blank at the attacking vessels. And then, of course, another run of 15 miles had to be made under fire of the near shore-batteries of the mole and the heavier coast-batteries of the mole and the heavier coast-batteries, as well. The German mine-fields also had to be circumvented.

Various elements had to be taken into consideration. Naturally the dash must be made at high tide. There was only one way in which we could hope to protect the vessels if the raid were made in daylight, and that was a smoke-screen. But aeroplanes, scouting above, would lay a fleet open to observation and to the same attack by indirect fires as on land. So the dash had to be made at night, and on such a night as the tide would be high at about midnight, for the ships must go in, do their destruction, and then come out again before the shore-batteries would have the daylight to help them.

There were something like 150 guns on the shore commanding the 15-mile radius. If these discovered the vessels, none of the ships could have lived through the shower of shells. As the batteries all had the use of searchlights and star-shells, it became necessary to take measures to prevent the ships being seen by any method of illumination until the last moment. That necessitated the use of smoke-screens. A smoke-screen is of little use unless it approaches with you; thus you must always have the wind blowing in your direction of advance. In our case it was from the north. The use of any craft to make smoke would not be effective unless it continued up to the coast, making smoke to the last minute. This necessitated light-draft vessels, and then in turn required calm weather.

So the conditions necessary demanded high water occurring at a particular period of the night, wind blowing directly into the harbor, cold weather, and, of course, no fog, for the latter would prevent the blocking-ships from finding the coast. Having attained these, there still were other matters to be worked out. In order that the blocking-ships might find their destination it was quite obvious that they must be able to see for a certain distance, say, for a mile or two, at least. And this means



THE PORT OF ZEEBRUGGE

that the moment the entrance to the canal was in the same area of clear atmosphere with the blocking-ships, namely, during the final run in, the shore-batteries on the coast-line also would be in the clear weather and able to concentrate on the blocking-ships, much to their detriment.

This applied both to Zeebrugge and Ostend, where the German batteries are on the actual coast-line. But at Zeebrugge there was the additional obstruction of the mole. This extends rather more than three-quarters of a mile from the entrance of the canal. The outer end of the mole had been turned into a veritable fortress. The position of the navigable channel leading to the entrance

was such that the ships were forced to pass close to the batteries on the mole, and it was too much to hope that they would be able to do this and pass inside these batteries and then meet the full blast of the shore-batteries without being sunk before reaching the canal. It therefore became clear that it would be necessary either to destroy or to divert the attention of the mole-batteries before the blocking-ships arrived in the vicinity, and in the latter case to keep them diverted until after the ships had reached their destination.

The German garrison on the mole was believed to consist of about 1000 men. It was decided to storm the mole with special parties immediately prior to the arrival of the blocking-ships. The necessity of holding the mole for a time would also provide opportunity to carry out a certain amount of destructive work on the mole. The possibility of reinforcement coming from the shore and preventing the storming party from attaining its object was to be countered by cutting the mole off from shore by blowing up the railway-viaduct.

The mole is a mile and a half long, and 80 yards wide. On the outer side it is flanked by a wall 30 ft. high. Five feet below the top of this wall is a narrow gangway or parapet running the whole length of the mole, with an iron hand-rail on its inner side. From the parapet there is a 16-ft. drop to the mole proper. The inner side of the mole is fitted to allow ships berthing alongside; whereas it probably was never considered that any ships would wish to berth along the outer side. The ships carrying the storming party could not go along the inner side of the mole without passing close to the mole-batteries, and thereby risking the certainty of being sunk. Therefore it was necessary for these vessels to be secured alongside the parapet of the mole, and for the storm parties to climb over the 30-ft. wall down to the parapet, and thence over the hand-rail and drop 16 ft. to the mole before they could attack the mole-batteries.

The operation went like clock-work. The 'Vindictive,' 'Iris,' and 'Daffodil' advanced alongside the mole in spite of the heavy fire from the mole-batteries. The arrival was at one minute after 12 o'clock at night, April 22-23, and the storm party disembarked on the mole immediately. The 'Daffodil,' pushing the 'Vindicator' alongside the mole, enabled this to be done. Because of the roughness of the sea the 'Iris' had difficulty in securing to the wall, and finally went alongside the 'Vindictive' with the intention of disembarking her men over that ship.

The Germans appear to have been taken completely by surprise. Immediately they heard the approach of the vessels they fired many hundreds of star-shells. But the smoke-screens prevented them from discerning the nature of the attack until too late. An old submarine, fitted with explosives, had run into and secured herself under the viaduct, and had been blown up after the crew had escaped in a small dinghy. This terrific explosion in their rear, the attack of the storm party in their midst, and the general confusion that must have reigned among them, were probably the cause of the Germans not noticing the approach of the blocking-ships. These passed close around the end of the mole and made direct for the canal-entrance. The leading ship, the 'Thetis,' was heavily engaged by the shore-batteries, but, although in a sinking condition, managed to direct the other vessels toward their destination. The 'Thetis' herself struggled on, and finally sank close to the canal entrance and right across the stairway. The 'Intrepid' and the 'Iphegenia' proceeded into the canal-entrance and sank in the positions ordered by blowing out their bottoms by mines especially placed for the purpose. Motor-launches had followed after the three blocking-ships and under terrific fire from almost point-blank range they went around the sunken vessels and took off their crews. This rescue-work was so magnificently carried out that practically none of the crews of the three blocking-ships was lost.

When it was considered that sufficient time had elapsed for the blocking-ships to do their work and for the crews to be rescued, the order was given to the storming parties to retire from the mole. While the 'Vindictive' and her consorts were actually alongside they were comparatively safe from fire except in the case of the upper works, which rose above the mole. The big funnels and masts of the 'Vindictive' had been riddled through and through, and many casualties were caused by flying splinters. As soon as the order to retire was given the storm-parties re-embarked. Some had been killed, several severely wounded, and yet out of about 400 men that had stormed the mole less than a score were left behind, in spite of the 16-ft. climb up the ladders and over the parapet. There must have been many acts of great gallantry to enable men who could not walk to be carried back on board amid heavy fire of the light guns on the mole and shell-fire from the shore-batteries, which had commenced to shell their own mole as soon as they discovered it was in our possession.

It was fully realized that immediately the ships shoved off the mole they would come under the concentrated fire of every battery that could bear. The 'Iris,' on leaving the 'Vindictive,' was severely hit and suffered many casualties, but the 'Vindictive' herself and the 'Daffodil' bore charmed lives. All three ships retired to the northward whilst emitting smoke-clouds to cover their retreat. In addition to the vessels already mentioned, a large number of small craft took part in the operation, and it can safely be said that any failure on the part of a single unit might have prevented the success of the whole expedition. Small motor-boats steamed up and down close to the shore-batteries, treating the latter with utter contempt. Destroyers supported the small craft, bombarded the enemy batteries, and assisted in the rescue-work with equal contempt of danger.

Vice-Admiral Keyes directed the whole operation, which had been prepared under his own supervision, from the 'Warwick,' and did not leave the scene of operations until the last of the blocking-ships' crews had been recovered. The spirit and determination with which he had imbued all his officers and men and his great quality of leadership made success as near a certainty as possibly could be done.

Determination of Chromic Oxide in Chromite

By W. C. RIDDELL and ESTHER KITTREDGE

*INTRODUCTION: The method described below was developed for the rapid determination of chromic oxide in ores and mill products submitted for analysis in connection with the War Minerals Investigation, being conducted by the U. S. Bureau of Mines. No particular originality is claimed for the method.†

The procedure has, however, been carefully standardized and data have been obtained regarding several important factors that may affect its accuracy.

ANALYTICAL PROCEDURE: The ore should be ground to about 100-mesh. Weigh out 0.5 gramme and brush into a 20-cc. spun-iron crucible in which has previously been placed 4 to 5 gm. of sodium peroxide. Mix thoroughly by stirring the charge with a glass rod, cover with a little sodium peroxide and fuse at a red heat. After the charge has melted, it should remain in the molten condition for five minutes. Allow the crucible to cool, place in a 400 to 600-cc. beaker of pyrex or other low-expansion glass, add about 100 cc. of water and digest until the fused mass has disintegrated, after which remove and rinse the crucible. Boil for at least five minutes to decompose the sodium peroxide. Without filtering, neutralize the solution with 1-4 sulphuric acid and add 25 to 30 cc. excess. Dilute to 300 to 400 cc. with cold water and titrate with a standard solution (about 0.2N) of ferrous sulphate. A slight excess of the ferrous sulphate solution is added, as indicated by spot-plate tests with a weak solution of potassium ferri-cyanide (about ½% solution) and the determination is finished by back titration with standard potassium-dichromate solution. The ferrous sulphate solution may be added rapidly without great care, as the approximate end-point is easily recognized by the color change of the solution. With some practice three or four spot-tests should be sufficient to determine the exact end-point.

The quickness of the method is due largely to the omission of filtration before acidifying the solution, and to the use of a standard $FeSO_4$ solution. One determination requires about two hours and a set of ten can easily be run simultaneously by one operation. This corresponds to about 40 determinations in an eight-hour day.

PREPARATION OF SAMPLE: Contrary to the statement found generally in text-books, extremely fine grinding is not essential. Reduction to 100-mesh is ample for all purposes, as is shown by the following analysis of three samples, which were submitted to the standard procedure except in the matter of grinding.

	Chromic Oxide (Cr_2O_3)		
	No. 1	No. 2	No. 3
	%	%	%
Ground to pass 80-mesh	49.6	35.4	53.8
Ground to pass 100-mesh	49.6	35.4	54.3
Ground to pass 200-mesh	49.8	35.4	54.1

DECOMPOSITION OF SAMPLE: Chromite, which is more difficult to decompose than the minerals usually associated with it, yields readily to fusion with Na_2O_2. The so-called 'technical' grade of Na_2O_2 may be used. A spun-iron crucible is usually employed and will last for five or six melts. If care is exercised the failure of the crucible does not necessarily mean losing the charge and in some 200 determinations only two fusions have been lost in this laboratory. When iron, as well as chromium, is to be determined in the sample a heavy 20-cc. porcelain crucible should be used. These crucibles will usually stand three or four fusions. An electric or other type of muffle-furnace held at low-red heat is preferred for making the fusion. The bottom of the muffle should be protected by a thick sheet of asbestos board or 'transite'. The charged crucibles may be placed at once in the hot muffle without danger of spattering, and covers are unnecessary. When the fusion is made over a burner, the crucible should be covered and considerable care exercised to avoid spattering.

The following experiments were made to determine the time required for the complete decomposition of the chromite by fusion with Na_2O_2. All samples were ground to pass 100-mesh, and except for the time of fusion submitted to the standard procedure.

	Chromic Oxide		
	No. 1	No. 2	No. 3
	%	%	%
Heated until just melted.....	49.6	35.1	54.9
Fused 2 min. after melting	49.8	35.4	55.0
Fused 5 min. after melting	49.9	35.4	55.1
Fused 10 min. after melting	49.8	35.4	55.1

From these results it is evident that it is amply sufficient to hold the charge in a molten condition for five minutes.

DECOMPOSITION OF H_2O_2 IN SOLUTION: The following experiments, which were identical except as regards time of boiling, indicate that five minutes is sufficient to decompose the H_2O_2 (formed by reaction of Na_2O_2 with H_2O) in solution.

	Chromic Oxide		
	No. 1	No. 2	No. 3
	%	%	%
Acid added without boiling.....	...	48.1	54.0
Heated just to boiling.....	14.8	49.3	55.1
Boiled for 5 min.....	14.9	49.4	55.3
Boiled for 10 min.....	15.0	49.3	55.2

*By courtesy of the Director of the U. S. Bureau of Mines.

†The method is based on information from the following sources: 'Quantitative Chemical Analysis,' Fresenius-Cohn, Vol. II. Pp. 421-428 (New York, 1911); 'Analytical Chemistry,' Treadwell-Hall, Vol. II. Pp. 675, 16a (New York, 1912); and 'Volumetric Analysis,' Sutton-Volumetric Analysis, Tenth Edition. Pp. 186 (Philadelphia, 1911).

If any H_2O_2 is present in the solution when the H_2SO_4 is added, some chromate will be decomposed, leading to a low result. The alkaline solution containing the precipitate inclines to bump on boiling. A few chips of fresh unglazed porcelain or a solid stirring-rod with a roughened end, placed opposite one of the points where the beaker makes contact with the hot plate, minimized this difficulty.

Non-Removal of Precipitate From Alkaline Solution: The quickness of the method is partly due to avoiding the tedious filtration of the alkaline solution. Except when manganese is present, filtration is unnecessary as is shown by the following parallel determination on a number of samples.

Chromic Oxide		
Solution acidified without filtration	Solution filtered before acidifying	In precipitate
%	%	%
38.5	38.6	..
40.4	40.0	0.3
56.4	55.7	..
49.3	49.1	0.2
53.8	55.3	0.3
55.2	55.0	..
55.8	55.6	..
55.7	55.4	0.2

In certain cases the precipitate, after considerable washing, was dissolved in acid. This solution was then made alkaline, the precipitate removed by filtration, and the chromium determined in the filtrate. These experiments show that it is quite difficult to completely remove the chromate from the bulky gelatinous precipitate. The short procedure which we have adopted is therefore the more accurate unless interfering substances are present.

Interfering Elements: Determinations were made in which small quantities of cobalt, nickel, and copper salts were added to known samples before starting the analysis. These additions did not influence the result.

Manganese is the only interfering element that is at all likely to be found associated with chromite. When this is present it will appear in the form of hydrated di-oxide as a brown gelatinous precipitate after the solution has been acidified. In this case filtration is necessary. Filtration may be considerably facilitated by the addition of masserated filter-paper.

Preparation of Solutions: The standard $FeSO_4$ solution should be about 0.2 normal. This solution is prepared by dissolving 56 to 60 gm. $FeSO_4-7H_2O$ in about 800 cc. distilled water to which has been added 100 cc. concentrated H_2SO_4. The heat generated by the addition of the H_2SO_4 readily affects the solution of the ferrous sulphate. After cooling, the solution is diluted to one litre. The 0.2 normal $K_2Cr_2O_7$ solution may be made by dissolving 9.806 gm. C.P. $K_2Cr_2O_7$ in one litre. The $FeSO_4$ solution may be standardized with a standard $KMnO_4$ solution based on Bureau of Standards sodium oxalate, or against the $K_2Cr_2O_7$ solution, provided this was made from a salt of known purity. The $FeSO_4$ solution acidified as suggested is quite stable and if properly protected requires checking against the standard $K_2Cr_2O_7$ solution only two or three times a week.

One cubic centimetre of 0.1 normal solution is equivalent to 0.001733 gm. of chromium or 0.002532 gm. of chromic oxide.

Patents

The Naval Appropriations Bill, which was approved by the President on July 1, 1918, contains a provision relating to patents that possibly is of importance in connection with Minerals Separation:

"The Act entitled 'An Act to provide additional protection for the owners of patents of the United States, and for other purposes,' approved June twenty-fifth, nineteen hundred and ten, shall be, and the same is hereby, amended to read as follows, namely:

"That whenever an invention described in and covered by a patent of the United States shall hereafter be used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, such owner's remedy shall be by suit against the United States in the Court of Claims for the recovery of his reasonable and entire compensation for such use and manufacture: provided however, that said Court of Claims shall not entertain a suit or award compensation under the provisions of this Act where the claim for compensation is based on the use or manufacture by or for the United States of any article heretofore owned, leased, used by, or in the possession of the United States: provided further, that in any such suit the United States may avail itself of any and all defenses, general or special, that might be pleaded by a defendant in an action for infringement, as set forth in Title Sixty of the Revised Statutes, or otherwise: and provided further, that the benefits of this Act shall not inure to any patentee who, when he makes such claim, is in the employment or service of the Government of the United States, or the assignee of any such patentee; nor shall this Act apply to any device discovered or invented by such employee during the time of his employment or service."

Potash and Blast-Furnace Gas

E. H. Lewis of the Glasgow Iron & Steel Co. publishes the following particulars of the amount of potash charged into the company's blast-furnace during the month of October 1917, and the amount recovered:

Charged into furnaces	K_2O %	K_2O per ton of pig-iron produced lb.
Iron ores	0.13	5.16
Coal and coke	0.05	2.15
Limestone	0.101	0.81
		8.12
Recovered		
Slag	0.146	1.63
Pitch	1.20	2.87
Tube-cleanings	2.23	0.07
Heavy dust from tubes	0.20	
Dirt from washers	1.20	
		0.07
Waste liquor	*2.49	1.58
Loss in running off slag and unaccounted for		2.10
		8.12

*Grains per gallon.

Need of More Gold

*The cost of mining gold, in the great goldfields of the world, is creating a new kind of 'currency problem.' The price of gold appears to be fixed because of its happening to be the standard of value; so many grains of gold to the pound, dollar, etc., being the method of standardizing the coinage of the money of the 'gold-standard' countries, it is inherently impossible to maintain gold parity and at the same time have gold, as a commodity, advance in price like everything else in the world. We have apparently come, in this war-time situation when we are seeing the fundamentals of finance as related to production and goods, to the point where the cost of running a gold mine is so high that gold either will have to bring a higher price or the mines must suspend. In South Africa, according to the recent reports of the meetings of the mining companies, the cost of getting gold is so high as to have compelled the British government to enter into some arrangement, the terms of which are not disclosed, although specific reference to it is made. In this country, also, the matter has come up in a serious problem.

Any proposal to put a smaller amount of gold into the standard coins, and so raise the price of gold by changing the standard, is declared by practical financiers and experts upon the subject to be out of the question. It would at once disturb the whole monetary situation, and as a re-adjustment would be faced when the reaction of prices that is ahead of us comes, we would have to undergo a double disturbance, and the expectancy of it would gravely affect credit. It would not even relieve the mining situation to debase the dollar, for costs, in terms of 'dollars,' would rise as the gold-value was reduced, and the whole proceeding would be merely juggling with words.

The problem is undoubtedly rendered more difficult by the fact of restriction of free sale and of the export of gold, as a war measure. On August 29, the Assay Office at New York was ordered by the Government not to sell any more gold bars to jewelers and others for "use in the arts" till further notice. It is reported from Washington that the Secretary of the Treasury has asked Congress to adopt a law against hoarding gold. The exportation of gold is restricted. Gold for manufacturing uses might sell at a premium, and it is believed that if our mining companies were free to export gold they would be able, for a time at least, to find markets abroad, for instance in Spain, where gold would be at a premium as against the dollar-credit, and even absolutely, and thus they might recoup themselves and incidentally help to get our trade-balances evened up on a cash instead of a credit basis. Such export would possibly be difficult to accomplish without running the chance of helping Germany in some way. However, the restriction of gold exports is generally ascribed as much to financial reasons —the desire to have a large store of gold for general credit stabilization—as to 'enemy trade' considerations, and it would seem as if the restrictions on domestic sale for manufacturing, and on export, were calculated to hold down the price.

There is another phase of the question, and that concerns the 'man-power' supply for war purposes. We need coal more than gold—if the gold miners were transferred to coal mining it would probably be an advantage, considering only the present conditions. But we will ultimately need the gold, and it would be dangerous to permit our gold production to be demoralized. Evidently the British government has seen fit to give artificial support to the gold mining on the Rand. It has been suggested that the soundest way to solve the whole problem raised by the cost of gold mining, under conditions of general price-levels and labor-shortage, which are regarded as temporary, would be for the Government to pay bonuses for the production of the gold, just as they are practically putting a bonus on wheat production, and thus to tide the industry over; for even the practical economists, who deplore general credit-inflation, which has given us so much credit-currency in place of gold as to be responsible for gold being so out of line as regards its price on a commodity basis, say that any interruption of the normal production of gold, which would affect the supply for a term of years, would be equally deplorable, as it would intensify the reaction from the present period of inflation, when it comes.

*'The Americas,' National City Bank, New York.

GOLD exports from the United States for August of this year amounted to $1,722,000, and for July $4,986,000. The total exportation of gold for the first eight months of 1918 was $18,073,000, against imports of $32,868,000, leaving a balance of imports of $14,795,000.

GASOLINE PRODUCTION of the United States in 1917, recovered from natural gas, totaled 217,884,104 gal., a gain of 111% over the output in 1916. The average recovery of gasoline per 1000 cu. ft. of gas by all methods was a half gallon. Oklahoma contributed 53% and California 13% of the total.

ALUNITE, many centuries ago, was mined in Smyrna, and for about 400 years in Italy, and was used for the production of potash alum. When the search for potash began in this country, it was believed that a deposit of alunite might be found and used as a source of potash rather than potash alum. Such a deposit was discovered in southern Utah, a few miles from Marysvale. Later it seemed that it would be necessary to discover some means of refining the alumina before potash could be produced in competition with Germany. Early in 1915, when the price of potash had risen to what seemed impossible figures, Howard F. Chappell and his associates of the Mineral Products Corporation, decided to build a plant, and this has been in continuous successful operation for three years, except for two shut-downs of one or two months each caused by fires. They are now producing and shipping about 600 tons of sulphate per month, the product being considerably better than 90% pure.

Review of the Gold Problem

By H. N. LAWRIE

Of the many complicated problems of war-production that the United States has confronted none offer more obstacles to correct analysis and solution than that of maintaining the output of gold on a normal basis. Much of the recent decline in the gold production of the world, and more particularly of the United States, involves an economic phenomenon unparalleled in history, and it is one that was not contemplated when the gold standard was adopted. Considering its far reaching importance it is strange that gold should be the last of a long list of metals to be given attention by the Administration. Apparently the monetary significance of gold does not carry with it the suggestion of utility in war as does lead, copper, or zinc.

That it should cost more to produce an ounce of gold as a commodity than the monetary price of $20.6718 per ounce, is an economic eccentricity; yet, when it is realized that this price was arbitrarily established by England in 1812 without regard to the cost of production, it does not seem so unreasonable, with the present inflation of commodity-prices, that this condition should exist. In fact the price of 85 shillings per ounce for gold, paid by England, in 1812 was above the market-price at that time. While it cannot be foreseen that commodity-prices will return to pre-war levels after the War, the present disparity between the cost of producing gold and its monetary price is probably temporary; therefore, a temporary expedient for the relief of this condition may be considered.

GOLD IMPORTS AND EXPORTS, UNITED STATES, 1914-'18. During the fiscal year 1913-'14, ended June 30, 1914, the United States exported $45,499,870 in gold coin and bullion more than was received by importation. In the next fiscal year the importation of gold exceeded the amount exported by $25,344,607. Had it not been for the fact that England promptly mobilized American securities held in England and used them in part settlement of her trade-balance with the United States the flow of gold in large volume into this country would have commenced sooner. Not until the second year of the War, that is, 1915-'16, did the effect of the liquidation of

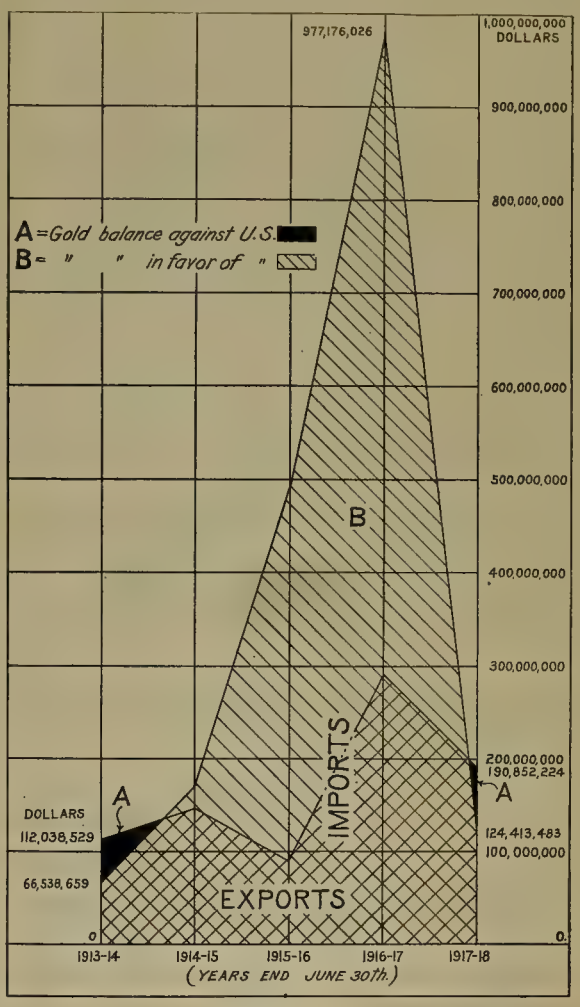


CHART NO. 1

GOLD IMPORTS AND EXPORTS OF THE UNITED STATES. FISCAL YEARS 1914–'18. DATA FOR CHART No. 1

Years end June 30	Exports	Imports	Gold balance against U. S.	Gold balance in favor U. S.	Excess imports over exports
1913-'14	$112,038,529	$66,538,659	$45,499,870	.....	−40.6%
1914-'15	146,224,148	171,568,755	.....	$25,344,607	+17.3%
1915-'16	90,249,548	494,009,301	.....	403,759,753	+447.3%
1916-'17	291,921,225	977,176,026	.....	685,254,801	+234.7%
Total three war years—					
1914-'17	$528,394,921	$1,642,754,082	.....	$1,114,359,161	+210.9%
1917-'18	190,852,224	124,413,483	$66,438,741	.....	−34.8%
Total four war years—					
1914-'18	$719,247,145	$1,767,167,565	$66,438,741	$1,047,920,420	+145.7%

United States gold reserve (gold coin and bullion) in the Treasury on June 29, 1918, was $2,478,221,424, of which $1,047,920,420, or 42.3% represents the gold balance in favor of the United States for the four war years, ending June 29, 1918. The statistics for 1914-'17 are from official records of the Department of Commerce; those for 1918 are reported by the Director of the Mint. The compilations and computations were made by H. N. Lawrie.

securities give way to substantial payment in gold, and consequently for that year the gold balance in favor of the United States amounted to $403,759,753. The third year of the War, 1916-'17, brought to our Treasury total gold imports of $977,176,026, being $685,254,801 in excess of the exports of gold for that year. In addition to maintaining forces abroad, the United States, upon joining the Allies, assumed immediately a large share of their financial responsibility, as is shown by the fact that in the year ended June 30, 1918, $66,438,741 in gold coin and bullion in excess of the gold imports was shipped out of the country to apply on trade-balances in foreign countries. To offset this drain upon the gold-reserve the importance of maintaining the pre-war output of new gold becomes apparent.

On June 29, 1918, the total gold-reserve in the United States Treasury amounted to $2,478,221,424. The gold balance against the United States for the year ended June 30, 1918, represents a loss to the gold-reserve of 2.7%. The total gold-balance in favor of the Treasury, namely, $1,047,920,420, which had accumulated in the four war-years, is 42.3% of the total gold-reserve on June 29, 1918.

It is estimated by Hennen Jennings that in December 1917 the total gold-reserve of the world was $10,000,000,000. This would have liquidated 35% of the total pre-war indebtedness of the combined belligerent nations, estimated at $28,290,000,000. The war-debt of all the belligerents has increased that indebtedness by $98,654,000,000, which makes the total indebtedness to December 1917, $127,944,000,000. In December 1917, therefore, the gold-reserve of the world would have paid but 8% of the debt of the combined belligerents, or a ratio of $1 in gold-reserve to $12.5 of indebtedness. On June 30, 1918, the total indebtedness of the United States amounted roughly to $12,500,000,000, and the gold-reserve bore a ratio to this indebtedness of approximately 1 to 5. The total indebtedness of the United States will approach $30,000,000,000 at the close of the fiscal year ending June 30, 1919,

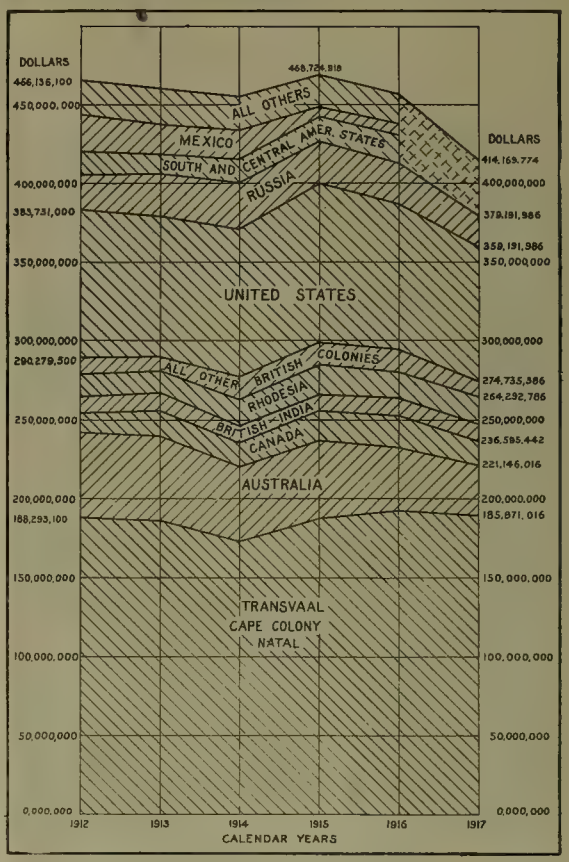


CHART No. 2

THE GOLD PRODUCTION OF THE WORLD. CALENDAR YEARS 1912-'17. DATA FOR CHART No. 2.

	1912	1913	1914	1915	1916	1917
South Africa	$188,293,100	$181,885,500	$173,560,000	$188,035,156	$192,182,902	$185,871,016
Australia	54,509,400	53,113,200	46,710,200	48,988,177	40,408,755	35,275,000
Canada	12,648,800	16,598,900	15,925,000	18,977,901	19,234,976	15,449,426
British India	11,055,700	12,178,000	11,378,400	11,522,457	11,206,509	10,744,882
Rhodesia	14,226,900	14,274,700	17,423,100	18,915,324	19,232,165	16,952,462
Other colonies	9,545,600	11,870,800	11,782,000	12,387,163	11,620,705	10,442,600
British total	$290,279,500	$289,921,100	$276,996,700	$298,824,178	$293,886,012	*$274,735,386
Increase or decrease		−0.1%	−4.0%	+7.8%	−1.6%	−6.5%
United States	93,451,500	88,884,400	94,531,800	101,035,700	92,590,300	84,456,600
Increase or decrease		−4.9%	+6.3%	+6.9%	−8.3%	−8.8%
Russia	22,199,000	26,507,800	28,587,000	26,322,746	26,322,746	20,000,000
South and Central America	14,956,100	13,020,700	14,775,700	17,135,841	18,097,224	†.....
Mexico	24,500,000	19,308,800	19,308,800	6,559,275	7,690,707	†.....
All others	20,750,000	22,298,300	21,476,600	18,847,178	18,419,056	†.....
Total	$82,405,100	$81,135,600	$84,148,100	$68,865,040	$70,529,733	†$54,977,788
Increase or decrease		−1.5%	+3.7%	−18.1%	+2.4%	−22.0%
World total	$466,136,100	$459,941,100	$455,676,600	$468,724,918	$457,006,045	$414,169,744
Increase or decrease		−1.3%	−0.9%	+2.9%	−2.5%	−9.4%

Of the total production of the world for the above six years, Great Britain contributed 63.4%, the United States 20.3%, and all other countries 16.3%.

For the year 1913 the Allies produced 91.3% of the gold of the world, the neutrals 8.1%, and the Central Powers 0.6%. (Computed by Hennen Jennings).

Statistics, 1912-1916, Records of U. S. Mint; for 1917, 'Mining and Scientific Press,' May 4, 1918.

*'Mining Magazine', May 1918. †By difference.

Compilation and computation by H. N. Lawrie; percentages of increase or decrease computed from year to year.

and the ratio between the gold-reserve and this indebtedness will be approximately as 1 to 12.5. It will be seen, from this comparison, that the United States is 18 months in the lead of the world in maintaining its ratio of gold-reserve with respect to the superimposed debt. This fact to a large extent pre-determines the position of the United States as the world's banker. It is important to realize that, when the United States exported for the past fiscal year roughly $66,500,000 in gold more than was imported, this quantity on June 30, 1919, will have a carrying capacity of 12½ times that amount in terms of the superstructure of credit, which expands to a total of $830,000,000. At this same ratio the normal production of $100,000,000 of new gold in the United States would sustain a super-structure of credit of $1,250,000,000 or an amount more than 80% of the total value of the cotton crop in the United States in 1917.

As the prospector, in time of financial distress, returns to a favored spot in the hills with the knowledge that he can make wages by crushing high-grade gold-quartz in a mortar, or by panning rich gravel, so the Nation must adopt a policy that will encourage exploration for new ore-reserves in the properties already equipped with mills and that will make prospecting attractive in new fields. Whether gold be in the Mint or blocked in the operating mines is merely a difference of position and of the small time-factor of mining and milling the ore. With the United States in the enviable position of being the world's banker, with each day adding new burdens to the gold-reserve, the time has come to estimate the gold-reserve contained in ore blocked in operating quartz and placer mines and to provide the economic conditions that will favor an extension of such tangible reserves. The day may soon come, if it has not already arrived, when gold in the proved ore-reserves of operating mines will be considered as much a national asset by our Government and financiers as the gold-reserve in the Treasury. To prepare for adequate reserves is to introduce a factor of safety that will protect not only the gold standard, but will expand the base of liquidating gold upon which will inevitably be erected a large credit for the period of reconstruction after the War has ended.

Gold Production of the World, 1912-'17. The year 1915 marked the high point in the world's gold production. Of the total of $468,725,000, Great Britain contributed 63, the United States 22, and the remaining nations combined 15%. The total British gold-production for 1915 was $298,824,000, of which the South

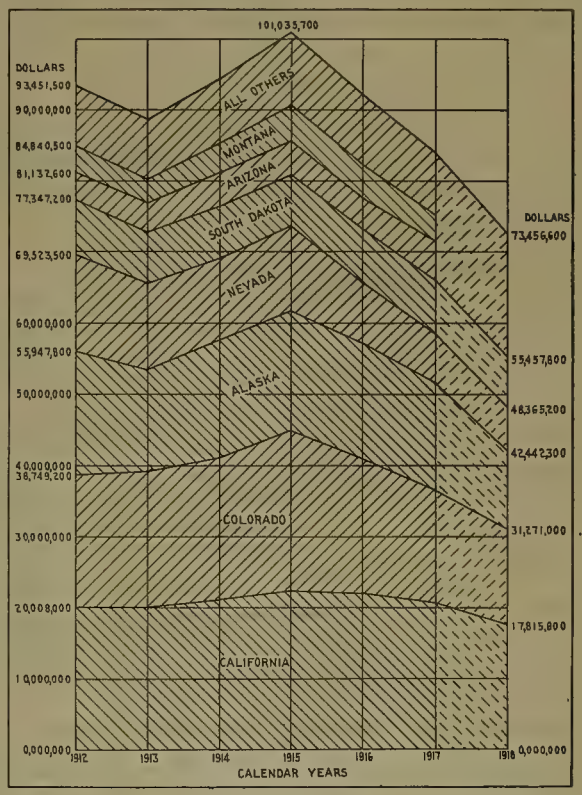


Chart No. 3

GOLD PRODUCTION OF THE UNITED STATES. CALENDAR YEARS 1912–'18. DATA FOR CHART No. 3.

	1912	1913	1914	1915	1916	1917	1918
California	$20,008,000	$20,241,300	$21,251,900	$22,547,400	$22,110,300	$20,815,900	$17,815,900
Increase or decrease	.....	+1.2%	+5.0%	+6.1%	−2.0%	−5.9%	−14.4%
Colorado	18,741,200	18,109,700	19,902,400	22,530,800	19,009,100	15,955,100	13,455,100
Increase or decrease	.....	−3.3%	+9.9%	+13.3%	−15.6%	−16.1%	−15.7%
Alaska	17,198,600	15,201,300	16,547,200	16,710,000	16,242,000	15,171,300	11,171,300
Increase or decrease	.....	−11.6%	+8.8%	+1.0%	−2.8%	−6.6%	−26.2%
Nevada	13,375,700	11,977,400	11,536,200	11,883,700	8,428,200	6,922,900	5,922,900
Increase or decrease	.....	−11.8%	−3.7%	+3.0%	−29.0%	−17.9%	−14.4%
South Dakota	7,823,700	7,214,200	7,334,000	7,403,500	7,512,200	7,392,600	7,092,600
Increase or decrease	.....	−7.8%	+1.7%	+0.9%	+1.5%	−1.6%	−4.1%
Arizona	3,785,400	4,101,400	4,568,900	4,555,900	4,378,400	5,533,800	.....
Increase or decrease	.....	+8.4%	+11.4%	−0.3%	−3.9%	+26.4%	.....
Montana	3,707,900	3,320,900	4,143,600	4,978,300	4,575,400	3,756,500	.....
Increase or decrease	.....	−10.5%	+24.8%	+20.1%	−8.1%	−17.9%	.....
All others	8,611,000	8,718,200	9,247,600	10,426,100	10,060,500	8,908,500	*17,998,800
Increase or decrease	.....	+1.2%	+6.1%	+12.7%	−3.5%	−11.4%	−1.1%
Total U. S.	$93,451,500	$88,884,400	$94,531,800	$101,035,700	$92,316,100	$84,456,600	$73,456,600
Increase or decrease	.....	−4.9%	+6.3%	+6.9%	−8.3%	−8.8%	−13.0%

*By difference.

Of the total gold production of the United States for the six years, 1912-'17, the seven States listed have contributed 90%, the remainder coming from all other States and dependencies of the United States. The statistics for 1912-'17 are from the official records of the U. S. Geological Survey. The percentage increase or decrease is computed from year to year. The compilation and computation was made by H. N. Lawrie. The estimates for 1918 are based upon estimates of the U. S. G. S. for six months ending June 30, 1918. Increases in Arizona and Montana offset losses in Utah, Idaho, and New Mexico.

African production of $188,035,000 constituted 63%, the Australian production of $48,988,000 17%, while the remaining 20% is made up chiefly of gold from Canada, Rhodesia, and British India. It will be noted that the relative importance of South African gold to the total British output of 1915 is the same as that of the total British gold output to that of the world, and, further, that the quota of gold from South Africa is practically double that from the United States. The gold output of the world for 1916 declined from that of 1915 2.5%; that of the British Empire 1.6%; while that of the United States was 8.3%. Had it not been for the more rapid falling off of the output from Australia the gains made in South Africa, Canada, and Rhodesia would have increased rather than decreased the total British output for 1916. Of the total decline of $11,725,000 in the world's output for 1916, the loss in production in the United States accounts for about $8,500,000, or 72%. It is evident not only that the economic pressure has been a greater factor in causing a more rapid decline in the gold output in the United States than in the British Empire, but that it began to operate sooner here than elsewhere. As further proof of this the world's decline in the gold output for 1917 amounts to 9.4%, that of the United States to 8.8, and that of the British possessions to 6.5%. Of the total decline of about $55,000,000 in the world's production for the two years 1916 and 1917, the reduction in the United States of $16,500,000 accounts for 30%. While the South African fields increased their gold-yield in 1916, an estimated loss of about $6,300,000 for 1917 indicates that the economic pressure had begun to operate there, remote as it is from the vortex of war. The very isolation of the South African fields and its distance from the centre of supplies probably necessitated laying in stores for a considerable period in advance of their need, and not until these had been consumed would the pressure of war-prices be so seriously felt. Again, the need of the mother country to augment its man-power did not fall so heavily on the ranks of labor in South Africa as in Canada and Australia.

Judging from the progressive decline in the Australian gold output, from $54,500,000 in 1912 to $35,300,000 in 1917, there is little doubt that the known gold-reserves of that country are becoming depleted, and that there has been a lack of new discoveries. From 1912 to 1916 the Canadian gold output increased continuously. The production in 1917 fell considerably, owing to the excessive drain on their man-power, and for practically the same economic reasons as have operated in the United States to cause their rapid decline, but Great Britain may look for an increase in the gold output from Canada after the War. The gold production of Rhodesia has closely paralleled that of the Canadian production from 1912 to 1916, and a decline of $2,280,000 from the production for 1916, being equivalent to 11.8%, indicates her response to the existing economic pressure. Rhodesia

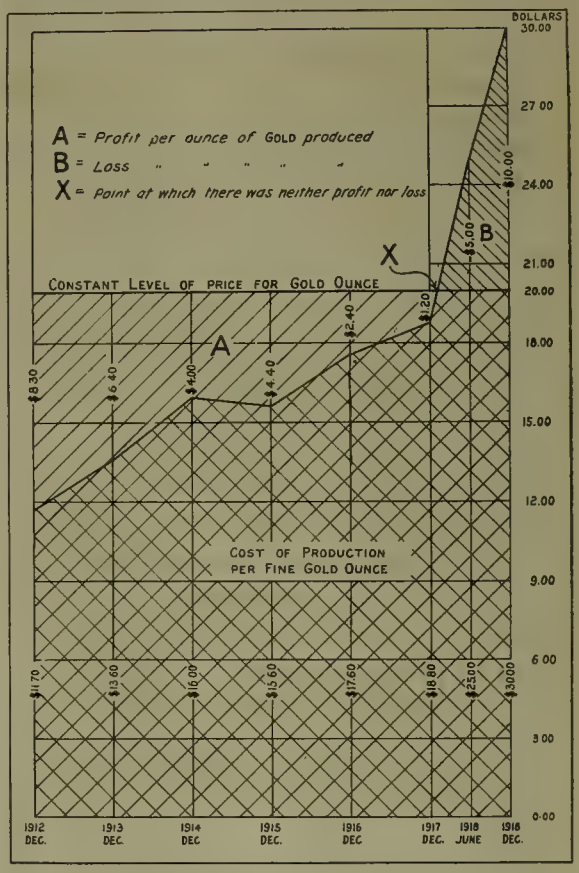


CHART No. 4

INFLUENCE OF THE WAR ON COST OF PRODUCING THE DOMESTIC GOLD OUNCE. TYPE EXAMPLE DATA FOR CHART No. 4

Month, year	Monthly output tons	Gold recovered per ton	Gold recovered ounces	Total cost per ton	Total cost for month	Profit or loss for month	Total cost per gold-ounce	Profit or loss per ounce
Dec. 1912	3,000	$12.00	1,800	$7.00	$21,000	+$15,000	$11.70	+$8.30
" 1913	3,000	11.00	1,650	7.50	22,500	+10,500	13.60	+6.40
" 1914	3,000	10.00	1,500	8.50	24,000	+6,000	16.00	+4.00
" 1915	6,000	9.00	2,700	7.00	42,000	+12,000	15.60	+4.40
" 1916	6,000	8.50	2,550	7.50	45,000	+6,000	17.60	+2.40
" 1917	6,000	8.50	2,550	8.00	48,000	+3,000	18.80	+1.20
June 1918	6,000	8.00	2,400	10.00	60,000	−12,000	25.00	−5.00
Dec. 1918	6,000	8.00	2,400	12.00	72,000	−24,000	30.00	−10.00

The above data represent a type example of a medium-grade gold-quartz mine. It takes into consideration the economic factors over this period of time. The whole numbers are used to simplify the presentation, and the price of $20 for the gold-ounce also simplifies the calculations. Many properties in 1914, working on a narrow margin of profit, were forced to enlarge their scale of operations as did this one. At this time wages were reasonable, prices for supplies had not passed the economic limit, and these facts combined account largely for the increase in the gold-output of the United States which was recorded in 1915. The compilations and computations were made by H. N. Lawrie.

probably will contribute an increasing amount of gold as conditions revert toward the normal. British India has maintained a constant level of production for the years 1912-16, with a small decline in 1917, which would indicate her inability to enlarge the world's output in the future.

If the United States can put into effect measures for relief sufficient to weather the present crisis, which threatens to close many properties, some of which will be totally lost on account of the excessive cost of reopening, the pre-war yearly output of $90,000,000 to $100,000,000 of new gold may be relied upon.

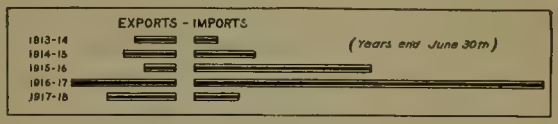
Russia offers the largest opportunity, especially in Siberia, for a substantial development after the War, which will aid in maintaining the normal gold output of the world.

Mexico's decrease in gold production from $24,500,000 in 1912 to $6,500,000 in 1915, the year in which the pinnacle of the world's production was recorded, is a tragic evidence of the rapid economic decline into which a nation can fall when law and order are replaced by repudiation and murder.

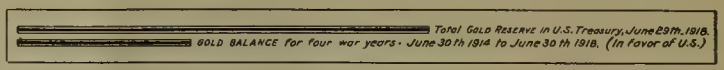
With the resumption of normal conditions the possibilities of maintaining the gold output of the world on a pre-war basis are not discouraging. It is noteworthy that the British and the United States gains in production for 1915 were sufficient to produce the high point in the world's gold output in spite of the fact that the combined quota from the remaining countries suffered a loss that year of about $15,000,000.

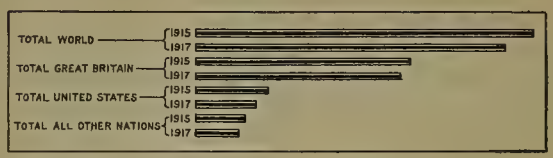
GOLD PRODUCTION OF THE UNITED STATES, 1912-1918. It has already been shown that the economic pressure on gold mining in the United States was more severe than elsewhere in the world, and forced an earlier decline in production. The decrease was $16,500,000 in the two years 1916 and 1917, and, based upon estimates for the first six months of 1918, a further decline of $11,000,000 is assured for this year, with indications that a more rapid decline will ensue in the last six months of 1918, unless immediate relief is accorded the industry.

Of the total gold output of the United States in 1915 of $101,035,700, California produced 22.3%, Colorado 22.3, Alaska 16.5, Nevada 11.7, South Dakota 7.3, Arizona 4.5, and Montana 4.9. These six States and the Territory of Alaska produced 89.5% of the total gold output for 1915. The remaining 10.5% came from other States and dependencies. California and Colorado together contributed 44.6%, and, including Alaska, the proportion of the total output is raised to 61.1%. In round numbers the decline in the gold output of the United States for 1916 amounted to $8,700,000 or 8.3% of the total for 1915, of which 80% is due to the decline in Colorado and Nevada, these being about $3,500,000 each. The major part of the gold production of those States is derived from lode-mining, where labor is a more important factor in the cost than in placer mining. The ores are mostly complex, and require smelting or other special treatment, which makes additional labor necessary and adds the cost of high-priced fuel and chemicals. For these reasons the economic pressure was felt in Colorado and Nevada more quickly than elsewhere, and the first effect was to curtail exploration, which automatically diminished the production. Further proof is afforded by the continuous decline in the gold output of Colorado and of Nevada for 1917. The total yield in gold for the United States was roughly $84,500,000 in 1917, a reduction over that for 1916 of about $8,000,000,

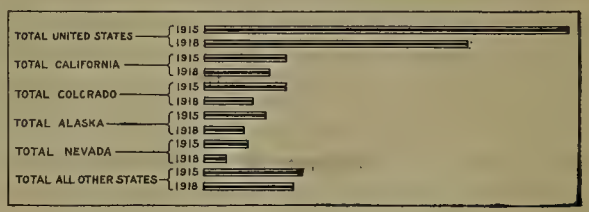


GOLD COIN AND BULLION EXPORTS AND IMPORTS


Total Gold Reserve in U.S. Treasury, June 29th, 1918.
GOLD BALANCE for four war years. June 30th 1914 to June 30th 1918. (In favor of U.S.)



GOLD PRODUCTION OF THE WORLD

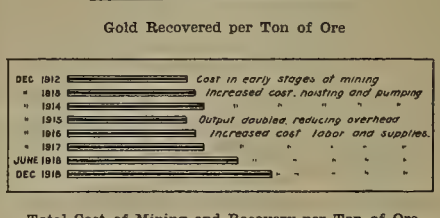


GOLD PRODUCTION OF THE UNITED STATES

or 8.8%. The combined losses of Colorado and Nevada for 1917, $4,500,000, account for 56% of the total decline, while the notable falling off in the gold output of

EXAMPLE FROM TYPICAL GOLD MINE

Gold Recovered per Ton of Ore



Total Cost of Mining and Recovery per Ton of Ore

California ($1,300,000), Alaska ($1,000,000), Montana ($800,000), and over $1,000,000 from all other sources, not including Arizona, indicates that the increased cost of operating extended in that year to the districts enjoying the most favorable operating conditions.

It is not surprising, therefore, that the estimates of the U. S. Geological Survey for the gold production in 1918, based upon the six months ending June 30, 1918, assume a decrease in the gold output of California of approximately $3,000,000, of Colorado $2,500,000, of Alaska $4,000,000, of Nevada $1,000,000, and of South Dakota and Oregon $300,000 each. While Colorado is still the centre of extreme economic pressure, the decline has been so general throughout the chief producing areas as to threaten the existence of the gold-mining industry. The estimated decrease in the gold output for 1918, based upon the first six months of operation, is certainly conservative, for there are many large producers about to close unless immediate relief is given. This will cause a more rapid decline during the last six months in 1918. The decrease this year is more likely to be as much as $15,000,000 or $20,000,000, reducing the total production for the year to $65,000,000, representing a total loss of 35% from the 1915 production of $101,000,000. In order to check the further and more rapid decline of gold production, ample labor will have to be provided, not only for the work of mining, smelting, and milling, but for increasing the amount of development, which has been neglected in the past three years.

THE INFLUENCE OF THE WAR ON THE COST OF PRODUCING DOMESTIC GOLD. In presenting the type-example to show the influence of the War on the operation of a mine containing ore of medium grade it is not intended to represent the maximum effect of the economic pressure. It is apparent that the lower-grade ores, which require from 10 to 20 tons to produce an ounce of gold, would have reached their economic limit of production earlier than the one which has been selected for the example, and that the cost per ounce from these lower-grade ores would now be higher than that in the case cited. The amount of gold contained in the ton of ore mined and milled in December 1913 declined from the recovery per ton in December 1912, 8.5%, while the cost of mining increased 7.1%, and the corresponding cost of producing the gold ounce increased 16.3%. In December 1914, the gold recovered per ton fell 9.1%, the cost of mining increased 6.7%, and the cost of producing the gold ounce 18%. It became apparent that the steadily diminishing value of the ore, in this example, coupled with the increased cost of mining, would force the closure of the mine early in 1915, so the tonnage was doubled in order to reduce the cost of production. The diminishing value of the ore as depth is gained on the deposit is not unusual, and must be taken into account in estimating the economic strain on the industry, although it is not in itself a component of the economic pressure that is accountable for the recent curtailment in output. In the same way the cost of mining and pumping increases with the depth at which the ore is removed from the mine. This would be true with steady conditions of labor and commodity-prices. However, the economic pressure that began to be felt by the industry in 1916 has gradually augmented the cost until in many instances it has become prohibitive and the mine shut-down. The management of the property taken as an example doubled the output of the mill, bringing it to six thousand tons per month in 1915. The ton-value of the gold recovered in December 1915 showed a further decline of 10%, but the operating costs, in response to the doubled capacity, were reduced 12.5% and the cost of producing the gold ounce was decreased 2.5%. For December 1916 a further reduction of 5.6% in the gold recovered per ton of ore, coupled with an increased operating cost of 7.2%, advanced the cost of producing the gold ounce 12.8%. In December 1917 the gold recovered remained the same as in 1916, and the additional cost of operation of 6.7% caused a corresponding increase in the cost of producing the gold ounce of 6.7%. In June 1918 the gold recovered dropped 5.9%, the cost of operation increased 25%, in consequence of the rise in wages and commodity-prices, which combined to increase the cost of producing the gold ounce 33%. The record for December 1918 has been assumed to show no decline in the gold recovered per ton, but with an increase in the operating cost of 20%, which results in a corresponding increase of 20% in the cost of the gold ounce.

The point at which the operation of this mine would have been making neither gain nor loss, that is, when the cost of producing the ounce would have equalled its monetary price, would have been in the early part of 1918, at which time the management would have shut the property down, or sustained a loss in future operation. If the owner continued to operate until June 1918 his loss would have been $5, and if continued to December, $10 per ounce of gold produced.

Many properties not so fortunate as this one in having so rich an ore were forced to close during 1916 and 1917. There are others, stronger financially, that are now operating at a loss in order to hold their organization together and to save the ultimate extra cost of re-opening when normal economic conditions may be resumed after the War. This policy is followed in the belief that the Government needs the gold, and will aid the industry.

There is but one way to cope with this condition in order to prevent the practical extinction of the gold industry and that is to treat the matter as a war emergency and to establish an economic equilibrium for the gold miner. Some direct method of compensating for the increased cost of producing the new gold should be adopted, without disturbing the monetary standard. It is for the Government to decide upon the nature, extent, and manner of the relief necessary. It is the duty of the gold producer to make known to the Government the present cost per ounce of producing the new gold as fundamental to effective action. To ensure the maintenance of the gold output now will safeguard the gold standard through the crisis of war; it will secure for the Allies a favorable adjustment of indemnities with the Central Powers; it will constitute a superior basis for the credit-structure necessary for the work of re-construction after the War; and finally it will serve as a most effective means of regulating the economic regeneration of the Central Powers.

Federal Taxation and Finance of Mines

By J. F. CALLBREATH

*One provision of the present income-tax law that has worked much injustice to small companies and possibly has caused the Government to lose much larger sums, which over-capitalized companies have escaped, is Section 326 of the proposed Act, subdivision "a", subsection 2, containing the following language: "But in no case to exceed the par value of the original stock or shares specifically issued therefor."

To limit 'invested capital' to the par value of the stock taken in exchange for property at the time of its acquisition is peculiarly unjust to the smaller mining companies which, in most cases, are organized to own a single mine after its promoters have spent large sums in prospecting and developing. These owners in many instances have acquired and developed a large number of worthless properties before the mine became productive and have expended large sums of money to put it on a paying basis, not by sitting and watching it grow, but by the expenditure of large amounts of money, labor, and energy. By this means it has increased in value and should in justice be permitted to utilize this increased value in determining its invested capital. Under this part of the section, a company which issues stock conservatively in an amount less than the real value of the property, would be limited to such amount, even though the property had an actual value far in excess of the face-value of the stock, while a corporation that was grossly over-capitalized at the time of the purchase of its property for stock would get the benefit of the increased value of the property up to the par value of the stock issued. This inequity is cured where stock is issued with no par value (Sec. 325, paragraph B, page 61), but where the fiction of a corporation is issued as a convenient means for dividing the interest of business associates, and a share of stock represents a certain interest in the property of the corporation entirely uninfluenced by its face value, it seems evident that this limiting clause can but work injustice.

A specific instance will illustrate: A few years ago the executor of a New York estate, in order to divide among the heirs a mining property that could not then be properly liquidated, organized a corporation with a capital stock of $10,000, to which the mining property was transferred, and he divided the shares in the proper proportions among the heirs. In the year 1916 that corporation paid taxes on a valuation of $2,700,000. Under a strict construction of the present Revenue Law, and under the proposed law, the invested capital of this company, upon which it could make deduction, is limited to $10,000, while its actual invested capital is $2,700,000. Under the proposed law this company is liable to pay 8% on $2,690,000, or $215,200 more than it would have been required to pay had its capital stock been fixed at the fair value of its property.

It is understood that the Revenue Department, recognizing this injustice, has in some instances permitted this excess value to be treated as 'paid in or earned surplus', and by this device has avoided the unjust technical requirement of the law.

It would seem, in view of the large latitude of authority given to the Treasury Department, it should be intrusted with power to fix the value of the property of an under-capitalized corporation. The strict application of this provision is likely to work an equal injustice to the Government. Let us assume that a mining company had invested $500,000 in a property, and that 75% of its reserve had been worked out prior to January 1, 1917, so that during the taxable year the company had but 25% of its original investment involved. During the year 1917 this company might have made an unusual profit, but under the provision referred to, it would be permitted to deduct 8% of the $500,000 originally invested instead of 8% upon the $125,000 actually invested. It seems proper also to suggest that settlements made by the Treasury Department in good faith, and where all the facts have been presented by the taxpayer, should be considered as final. It seems but fair to business interests, after meeting all the requirements, to know that the matters are finally determined.

Much inequity has resulted from the custom of the Revenue Department in valuing orebodies at the purchase price "at the time of such payment", as required in Section 326, line 10, page 61. The result is to fix different values upon property in all respects absolutely equal in value. Companies A and B own adjoining sections of land of equal but nominal value for which they respectively paid $10 per acre. Each at an expense of $100,000 develop ore, oil, or coal, worth $1,000,000. Company B sells his holdings to Company C for $1,000,000. Company A is entitled to a deduction of 8% on the cost of the land ($6400) and the cost of improvements ($100,000) making a total of $106,400. Company C is entitled to a deduction on the cost of the property of $1,000,000. This is only an illustration, but inequities of this sort will be found in many, if not in all, districts. This grows out of the proposal that an orebody is worth just what it costs without regard to the losses in development of worthless properties, without regard to the hazardous nature of mine development, and without regard to the actual value of the property. It is fair to say that there will be few gamblers at the table where most men lose

*Portion of statement made to the Committee on Finance of the U. S. Senate, Sept. 11, 1918.

and where the winner is immediately divested of the rewards of his lucky chance; in other words, that the development of new mining properties will not be made except the successful operator is allowed a reward proportionate to the hazard involved in his enterprise.

It would seem that a distinction must be made in assessing a tax upon the earnings of an exceedingly short-lived enterprise, as compared with enterprises of longer life or those that are permanent in their nature. A bill recently passed by the House of Representatives (H. R. 11,259), known as the War Minerals Bill, had for its purpose the stimulation of production of certain minerals necessary in war-work, which heretofore have been imported from foreign countries and of which there is now a shortage. We have been importing above two million tons of manganese, chrome, and pyrite respectively, from Brazil, New Caledonia, and Spain. These minerals are absolutely essential in the manufacture of steel and explosives. The fact that the supply of these minerals had heretofore come almost entirely from foreign countries, affords proof that these industries probably cannot thrive at home under normal conditions unless protected by compensating import duties. No one can predict what the tariff policy of the United States will be after the War. In consequence no one is justified in expending a large sum of money for the development of a mine, or the construction of a treatment-plant in order to supply a temporary market. If the demand for these minerals shall be terminated in two years, then it is plain that a plant now erected must amortize the original investment during these two years, in addition to earning the ordinary profit. The deductions for depreciation cannot be made to meet the situation because at the end of the two years a plant might be at least 80% efficient, in which case a 20% deduction for depreciation for the two years would be fair, but the remainder would be entirely worthless unless the market conditions justified continued operation. I do not feel justified in suggesting that these enterprises be exempted from war-taxes, but I do urge that full authority be given and that this revenue law shall anticipate that deductions for depreciation of plants engaged in short-lived enterprises shall be sufficient to amortize the cost of construction and development during the working-period of the enterprise. Operations developed for the purpose of supplying these rare minerals, which are needed for war-purposes, can be more nearly compared to the housing facilities and plants constructed for war-purposes by the Government. At the conclusion of the War they will be practically valueless. The same principle applies to short-lived mining operations, whether terminated by want of a market or by the exhaustion of the orebodies.

Gold mining is the one business that is burdened by prosperity in other lines. If financial systems could be so arranged that gold were not the basis of credit, the production of gold would become a matter of small concern to the public. As long, however, as gold is the basis of our currency, it is essential that the proper ratio between credit-money and gold shall be maintained in order that our credit at home and abroad may be preserved. At the present time gold production throughout the world is falling off at a rapid pace. With the exception of a few high-grade mines, the production of gold, except in association with other minerals, is rapidly coming to a standstill. The cost of gold mining in the Western States has increased fully 60% during the last three years; the value of the product remains the same. The gold production of the United States during the last three years is as follows:

1915	$101,035,700
1916	92,316,100
1917	83,750,440

This shows a falling off approximately of 10% annually. The decrease during the present year will greatly exceed the ratio of the past three years. The great low-grade gold-producing mines of the country must close unless some special aid be given. This condition of the low-grade gold mines will not be affected by the new Revenue Act because these mines have no profits to tax. Gold, however, must command serious attention. A foundation sufficient to sustain a certain structure of credit may be found entirely unable to sustain a vastly increased credit. The United States is more fortunate than any other nation in the world in having the larger share of the world's gold-reserves. It will need to guard that reserve with intelligent foresight. In the enactment of a revenue law providing for the collection of a tax amounting to 80% of the total gold in the world, and two and one-half times our own gold-reserve, every precaution must be observed to maintain the replenishing stream of gold from new production. Some advocate that gold mining be exempted from the excess and war-profit taxes. I would urge you rather to assist the gold-mining industry that it shall be able to pay taxes. If the Senate Finance Committee cannot see its way clear to give serious consideration to legislation of this character, then I believe that gold mining should be exempted from the requirements of this bill. High-grade bodies of gold ore are not numerous, and are usually developed as the result of great expenditure and long and tedious operation. It is then exhausted in a short time. An orebody which has been sought for ten years and which may be exhausted in one, is a losing proposition if the production takes place at a time when the Government demands 80% of the net operating revenue as a tax. If that production had been scattered through the ten years of development work, there could be no objection to making the company bear its full share of the tax, but when the returns of ten years' effort are charged only with the expenses of one year, the injustice is self-evident. I predict that, before many years, not only this country but other countries will find it expedient to provide special inducements for the production of gold from low-grade deposits in order that a stable foundation may be provided for the rapidly expanding credits necessary in our commercial life. A million dollars in gold taken from the ground forms a reasonably stable basis for eight million dollars of national currency.

RENO, NEVADA

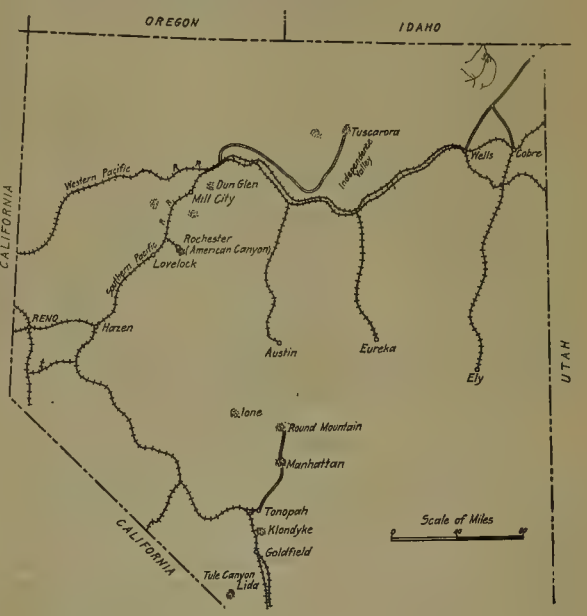
Exemption for Miners.—Carson Mint.—Amalgam in Carson River.—Placer Mining Possibilities.—Cyanidation Replaces Flotation.—Wall Street Mine.

The first claim for exemption of men engaged in essential industry in Nevada is being made to the district exemption board and to local draft boards by the U. S. Smelting, Refining & Mining Co. It asserts that it is engaged in an essential industry, and if the supply of silicious ores from Nevadan mines were to be interrupted it would become necessary to close down the company's plant in Utah. Similar claims for exemption of miners will be made by a number of mining companies.

Ray T. Baker, director of the Mint, who was to have attended a meeting of mint superintendents at Carson on October 15, has been ill at his Lenox, Massachusetts, home; but is said to have started for Nevada, so the postponed meeting will be held within the next few days. It is said that the subject of re-opening the Carson mint for the coinage of silver will receive serious consideration.

Further tests on the treatment of amalgam and concentrate taken from the bed of the Carson river, below the old mills that treated by pan-amalgamation the product of the Comstock bonanzas, have been conducted at the Mackay School of Mines. Interesting results have been obtained, especially in connection with the saving of 'floured' quicksilver, which was thought to have been carried away by the water. These tests not only have indicated the presence of a large quantity of the floured mercury, it is said, but afford promise of a high recovery by washing over tables. In all tests for saving the amalgam and fine material, primitive methods of sluicing and washing have achieved the best results. There is no lack of water in the river for large-scale operations; on the contrary, work is hindered at times by an excessive flow during storms, and it may become necessary to construct diverting-dams above the point of operation.

Placer mining is now attracting more interest in Nevada than for many years. A dozen or more districts in the State yielded placer gold in the early-day operations, conducted in many instances by Chinese miners; but the lack of water has long been supposed to preclude successful placer mining. The only important operation of this character in late years has been that of the Round Mountain Mining Co., in northern Nye county. In recent months, Goldfield men have been prospecting the bed and tributary gulches of Tule canyon, an off-shoot of Death Valley, in southern Esmeralda county; and have found rich gravel above shallow bedrock at many points for a distance of five miles along the bed of the canyon. Several districts in Humboldt county produced placer gold in large quantity, including American canyon, near the present town of Rochester; Rabbit Hole basin, 30 miles north of Lovelock; Horse Creek canyon, at the northern extremity of the county; Dry canyon and Spring valley, south of Mill City; Barber canyon and Dun glen, east of Mill City. It is said Wells Fargo & Co.'s receipts show that Chinese miners shipped $12,000,000 in gold from Barber canyon in eight years. In Elko county, the Tuscarora district, on the border of Independence valley, and the Bull Run placers, farther north, sent out quantities of gold. Rich gravel has been found in the region drained by the Little Salmon river, in the far northern part of Elko county, and in Squaw valley, west of Tuscarora. Nye county, in addition to the Round Mountain placers, contains ground that was worked profitably many years ago and within recent months gold was being taken from placers near Ione and in Golden canyon, near Smokey valley. In Lander county, the Copper canyon placer mine



MAP OF NEVADA, SHOWING GOLD PLACER AREAS.

is now being worked successfully, and a placer boom some three years ago resulted in founding the camp of Bannock, now nearly deserted. Esmeralda county has many promising fields for placer mining in addition to the Tule Canyon region. Chinese and white miners produced gold from placers at Klondyke, midway between Goldfield and Tonopah, some 40 years ago, and their workings are still to be seen. Good nuggets, one valued at $1200, have been found here in late years. Gold Mountain, Fish Lake valley, and the Lida districts are said to contain placer ground of great value. Of course, the Manhattan gravels must not be forgotten. Dry washing has been successful only under certain favorable conditions, but nowhere in Nevada has the problem of recovering placer gold been attacked seriously or with equipment other than that available to the prospector.

Mill City is growing busier as a result of tungsten mining near by. If placer mining is revived it should still grow. There is said to be manganese in a canyon not far away.

The flotation mill of the Jefferson Gold & Silver Mining Co., as mentioned before in these letters, operating at the old Kanrohat mine in Jefferson canyon, near Round Mountain, will be partly dismantled in order to revert to cyanida-

tion again. The ore is oxidized and recovery by flotation was not satisfactory. It will be necessary to pipe the waste solution and tailing out of the canyon, a distance of nearly three miles, to avoid damage to the Round Mountain water-supply and to avert danger of poisoning cattle. The manager, S. H. Brady, says that development in four tunnels is opening a large tonnage of high-grade milling ore.——The Louisiana Consolidated Mining Co. is said to have closed down its mine and mill. It was announced some time ago that Samuel Newhouse of Utah had become president and controlling factor, succeeding Walter Trent, who has entered the Army.

Tests have been conducted for some time at a small plant near Los Angeles to devise some method of treating ore from the Jumbo Copper Mountain Mining Co. The mine has been opened to a depth of 385 ft. Most of the ore above that depth is oxidized, the deeper workings have entered the sulphide zone. While the tests are not conclusive, and the plant may be enlarged to secure more dependable results, it is shown that the sulphide ore will yield a 92% recovery by flotation. The latest tests indicate that leaching in a salt solution, under agitation, will yield 92% of the copper content of the carbonate ore. The tests include treatment of the flotation concentrate.

The Wall Street mine near Luning, in Mineral county, has been shipping 7% copper ore at the rate of 700 tons monthly. The ore also contains 3 oz. of silver per ton. It is shipped to the Hazen sampler of the Western Ore Purchasing Co., thence to smelters in Utah. The manager, J. B. Kendall, formerly mine superintendent for the Goldfield Consolidated, reports 40,000 tons of low-grade ore used as stope-filling and 12,000 tons on dumps. He says that this ore assays 3% copper, 3 oz. silver, 20% iron, 19% lime, and 45% insoluble. The Wall Street mine is owned by A. H. Howe, secretary and treasurer of the Goldfield Consolidated, and Charles R. Evans, democratic nominee for Congress. The mine has been producing ore of shipping grade for the past three years.

MAYER, ARIZONA

Recent Development of the Copper Properties.

The Little Egypt copper property, which is situated a half-mile east of Mayer, has been financed by W. A. Davidson of Prescott. The mine was owned by Charles S. Vivian, of Humboldt, and William Beldford, of Mayer. A steam hoist has been erected at an old shaft which is to be sunk 600 ft. Shipments of ore are to be made to the Humboldt smelter from surface workings. A. L. Blumenauer of Jerome will be mine superintendent.

The Swastika silver mine has been taken over by the Consolidated Arizona Smelter Co. The property has been worked under lease by F. W. Giroux, who shipped 50 cars of high-grade ore. Claude Ferguson, formerly superintendent of the Copper Queen at Stoddard, has been retained as mine superintendent of both the DeSoto and Swastika mines. The Swastika is sending three cars per week to the smelter at Humboldt. Development is expected to explore a large territory of silver ore.

The Arizona Binghampton company has decided to sink 1200 ft.. and enlarge the flotation mill. Over 31,000 lb. of copper was produced during the first six days of October. About 30 tons of concentrate is produced daily from 170 tons of ore.

The Big Bug Copper Co. has commenced sinking on a promising outcrop in the Copper Mountain district. A gasoline hoist was recently moved from another property owned by the company to this shaft. At a depth of 60 ft. there is 15% showing.

Development in the Kay mine during the past 30 days shows a drift 140 ft. on the 500-ft. level in ore averaging 15% copper and $3 gold; a cross-cut driven east 75 ft., all in ore running from 1½ to 5% copper with some gold and silver; and a cross-cut 70 ft. from the main shaft in 20 ft. of 18% copper ore. Extensions are to be made. This mine is attracting a great deal of interest locally on account of the size of the orebodies and the uniform metal content. George W. Long, president of the company, has moved from Oatman to Phoenix. He is at present in New York conferring with the shareholders. A large flotation plant is contemplated. The ore is chalcopyrite. The Kay mine is located about 25 miles south of Mayer.

The shaft at the Pentland mine is down 650 ft. A cross-cut 12 ft. west at the 600-ft. level cut the orebody, which, at the 500-ft. level, was 14 ft. wide, averaging 4% copper. The shaft is to be continued to the 1000-ft. level.

CRIPPLE CREEK, COLORADO

General Notes from the District.—Drainage-Tunnel Operations.

The Vindicator Consolidated will resume payment of quarterly dividends on October 25. No. 81, of 1c. per share, will amount to $15,000.

The Lincoln Mines & Reduction Co. has graded a site and is now laying foundations for a concentrating plant on the property of the Rex Gold M. & M. Co., on Ironclad hill, the scene of the recent manganese discovery. The first unit will have a daily capacity of 100 tons.

Production of the United Gold Mines in September, from lessees, totaled 1540 tons with a gross value of $25,000. The mines producing were the Trail on Bull hill and W. P. H. on Ironclad hill.

Production of the Acacia company in September totaled 200 tons of 1-oz. ore.

Work in the Roosevelt tunnel during September amounted to 566 ft., of which 322 ft. was in Portland ground on Battle mountain and 214 ft. in the property of the Cresson Consolidated on Raven hill. The drift from the tunnel-level reached its objective directly under the Cresson shaft on October 14. A raise has been started to connect with the sump 31 ft. above the tunnel-level.

COBALT, ONTARIO

Tailing Treatment.—Geologic Exploration Near the Contact.

The McKinley-Darragh-Savage company will close its 200-ton flotation plant during the winter, it being considered more economical to treat old tailing during the open season. The plant is expected to be closed early in December. The mill, however, will be kept in full operation.

A new development, one full of interest to property owners in the Bucke Township section of the Cobalt silver area, is the decision this week to sink a shaft to a depth of 300 ft. in ground recently purchased from the Nipissing Central Railway by the Mining Corporation. It lies on the west side of the railway at North Cobalt. In the keewatin formation, immediately above the underlying diabase, a series of veins have been cut in the Adanac mine. They range from mere stringers to 8 in. in width. They consist of calcite, in which cobalt and a little native silver is present. The zone of operation is similar to that wherein the larger portion of the big output of the adjoining Temiskaming mine was found. Driving along the veins is under way.

Kerr Lake company pays 25c. per share on December 16. This is equal to $150,000, and makes $600,000 for 1918, and $8,010,000 to date.

Nipissing produced silver worth $256,461 in September. This is still much lower than the average for the first 7 months of the year. The high-grade mill treated 98 tons of ore, and the low-grade 6348 tons. Including custom metal, the refinery shipped 513,713 ounces.

THE MINING SUMMARY

ALASKA

Bethel.—According to D. S. McAlpine, of the power-schooner 'Ruby,' who arrived at Seattle on the 15th, miners in the Kuskokwim River district are threatened with famine

SOUTH-WESTERN ALASKA, SHOWING KUSKOKWIM REGION.

before winter sets in. The 'Ruby' was the only vessel that went to this region this season.

Juneau.—October 18 was the 51st anniversary of the ownership of this Territory by the United States. In 1867 it was purchased from Russia for $7,200,000, since when the output of gold, copper, minerals, fish, and fur has been at least 100 times greater than the price paid.

Kennecott.—The Kennecott Copper Corporation produced 5,508,000 lb. in September. This is the highest return since April.

ARIZONA

Ajo.—New Cornelia produced 3,744,000 lb. of copper in September, 400,000 lb. below the year's average.

Bisbee.—Calumet & Arizona produced 4,868,000 lb. in September, the largest for the current year.

Clifton.—Arizona Copper produced 4,330,000 lb. in September, 30,000 lb. above August.

Crown King.—The Philadelphia Mining Co. has been formed to operate the Nelson gold mine here. A 1000-ft. tunnel is to be driven to cut the orebody at the 960-ft. level.

Globe.—Old Dominion produced 2,292,000 lb. of copper in September, 600,000 lb. below the average for 1918.

Arizona Commercial pays 50c. per share on October 31. This amounts to $87,500.

It is reported that the Iron Cap company has entered into a contract to obtain power from the Inspiration Consolidated company.

Construction has been commenced on the mine-rescue building of the Globe-Miami District First Aid and Mine-Rescue Association.

Kingman.—The McCracken Silver-Lead Mines Co. has intersected the vein, and 150 ft. of driving has opened a large quantity of $20 ore.

Miami.—The Miami Copper Co. pays $1 per share on November 15. This is equal to $747,114.

Inspiration Consolidated produced 7,800,000 lb. of copper in September, 700,000 lb. below the average for the year.

Oatman.—A. C. Werden, of the Gold Ore company, reports that work in the west drift continues to open ore which averages $20 per ton. Cross-cutting toward the shaft is to be commenced and preparations for stoping carried out.

It is reported that driving to the south on the seventh level of the United Eastern has opened ore for 30 ft. assaying over $20 per ton. The width of the vein is not yet known.

CALIFORNIA

San Francisco.—The following questionnaire has been sent to producers of chrome ore in the Pacific States. If any producer has failed to receive this questionnaire, he is requested to use the text of it as given herewith, and to send his replies without delay to the address specified:

As a producer of chrome ore you are requested to furnish answers to the following questions in order to assist the Pacific Coast Chrome Producers Association in its efforts to obtain protection for the industry. If you cannot promptly answer all the queries, kindly reply to as many as possible and return the questionnaire immediately. Additional data submitted, either with this questionnaire or later, will be appreciated. To secure results, haste is important. Mail your answers to Courtenay De Kalb, 420 Market street, San Francisco.

1. Name of your property.
2. Situation of your property:
   - (a) State.
   - (b) County.
   - (c) Post-office address.
   - (d) Shipping-point.
   - (e) Direction from shipping-point and distance.
3. Who is the owner or lessor of the mine?
4. When did you begin operating?
5. How many tons have you produced?
6. How many tons have you shipped?
7. How many tons have you mined?
8. Have you any ore remaining unsold? and how much?
   - (a) At shipping-point.
   - (b) At mine.
9. What grades of ore have you been shipping?
10. Have you contract for future delivery of ore?
11. How many tons contracted?
12. How many tons do you estimate that you have available but unmined?

13. Can you state probable grade of such tonnage?
14. If you have a concentrating-mill please state:
    (a) Daily capacity, tons of raw ore.
    (b) Concentrates produced, tons ...., grade .....
15. What have been your average costs per ton of ore at shipping-point?
16. How much money have you expended in road construction?
17. What have been your initial expenditures for buildings and equipment?
18. How large has been your total investment in the operation?
19. Would liquidation of your chrome business at this time involve a net loss? .... How much? ....
20. How large has been your total net return applicable to amortization of capital and of profit?
21. What led you to turn your attention to chrome production?
22. Do you believe that a fixed price for chrome ore should be established?
23. Can you make a profit on your operation at $1.25 per unit of Cr_2O_3 for 38% ore, as a base price for the schedule?

Amador.—The Central Eureka company's superintendent states that the winze is down 15 ft. below the 3500-ft. level, where there is from 10 to 13 ft. of quartz. Free gold is visible, and the average assay is $25 per ton. Other parts of the mine look well.

Garden Valley.—The Black Sand Gold Mines Co. of Garden Valley, Yuba county, has been given a permit by Commissioner of Corporations E. C. Bellows to sell four shares to its incorporators at par for cash and 999,996 shares to W. H. Simpson for the assignment to it by him of the option to purchase the Nevada placer mine, in Green Valley district.

Kennett.—The hoisting-plant of the Shasta King mine was burned on the 10th. The loss was $3000. The machinery was on the Balaklala tram-line, and was used to raise ore from the Shasta King to the tram for shipment by aerial tram to Coram, thence to Kennett. The damage will be made good within 10 days. In the meantime, ore extracted is stored in the mine. The Shasta King, a Trinity Copper Co. property, is operated by the Mammoth Copper Co. under lease and bond.

Lowrey.—The Noble Electric Steel Co. has closed its chrome mines for the winter. E. W. Bedford is superintendent. The property is several miles from this place.

Sutter Creek.—The Old Eureka shaft is down 2650 ft. Sinking continues at the rate of 125 ft. per month, the objective being a depth of 3150 ft. Some good ore is said to have been opened at 2150 ft., and is being followed.

Trinity Center.—The Big French Flat Mining Co. is to issue 4500 $1 shares to E. G. Gould and others. To clean-up the bed of Trinity river, it is proposed to divert the water through a tunnel in the bend at Big French flat.

Twelve hundred tons of machinery is arriving at Redding from the East, and is being transported by auto-truck to Trinity Center for the Estabrook Gold Dredging Co. This work cannot be completed before snow blocks the mountain roads.

COLORADO

Black Hawk.—Equipment of the Fifty Gold Mines Co. was bid for last month by Morse Bros. of Denver for $22,500. The bankruptcy court considered this not enough, as the sale must pay all indebtedness—$41,808—so E. Sabin, representing Eastern people, paid this amount. Morse Bros. objected, and were granted a stay of five days to formally file their reasons. The new owners are to re-open the properties at once.

Cripple Creek.—Cresson Consolidated made a profit of $104,650 during August. The regular monthly distribution of $122,000 was made last week. Fully developed ore-reserves were valued at $2,948,000 on September 1. Cash on the 30th was $1,040,691, plus ore in transit valued at $30,000. On No. 16 level, No. 49 diamond-drill hole cut 20 ft. of low-grade ore.

Manganese has been discovered on Ironclad hill. F. M. Van Tuyl, of the State School of Mines at Golden, has made an examination. The ore is found in a volcanic breccia to a depth of 100 ft. The deposit is 'spotted,' that is, occurs as small pockets, this rendering its persistence as uncertain.

Vindicator pays 1%, or 1c. per share on 1,500,000 shares, on October 25.

Leadville.—At a depth of 128 ft. in the new Huter shaft of the Matchless property on Fryer hill, high-grade iron-silver ore has been opened.

The Doty Manganese Co.'s shaft on Poverty flat is down 179 ft. on its way to 250 feet.

Good progress is being made in extending the Anderson tunnel in Prospect mountain. A silver-bearing vein was recently cut.

MICHIGAN

Houghton.—St. Mary's Mineral Land Co., which owns the Champion mine jointly with the Copper Range Co., distributes $160,000 on November 1. This is equal to $1 per share, making $5 for 1918. Also on November 15 there will be distributed 16/100 of a share of Mayflower-Old Colony and 36/100 of a share of Winona Copper Co. for each share of St. Mary held by holders of record on October 11. The St. Mary company is withdrawing from active participation in management of these other companies.

Copper production of Calumet & Hecla and subsidiaries during September was as follows:

Mine	September lb.	9 months lb.
Ahmeek	1,866,665	19,364,630
Allouez	510,000	5,545,853
Calumet & Hecla	4,964,872	51,538,796
Centennial	157,071	1,852,362
Isle Royale	1,185,643	11,061,998
La Salle	124,000	1,451,105
Osceola	1,153,217	12,297,843
Superior	120,000	1,391,856
White Pine	260,000	2,054,824

MISSOURI

Joplin.—Production of the Tri-State fields last week was 7426 tons of blende, 577 tons of calamine, and 1168 tons of lead. These averaged $54, $40, and $100 per ton, respectively. The total value was $545,650, of which Missouri yielded $86,861.

MONTANA

Butte.—Davis-Daly in September mined 3754 tons of ore, yielding 480,414 lb. of copper and 20,900 oz. of silver. Compared with August there was a drop of 220,000 pounds.

Saltese.—The Tarbox Mining Co., in charge of Richard Dixon, has 25 to 30 men at work. A cross-cut is being driven to the vein on the 1000-ft. level. The power reservoir has been improved, and one mile of 10 to 22-in. steel pipe has been ordered. This power will reduce mining and milling expenses by $1000 per month. An assessment of 10 mills per share has been levied. This will realize $20,000.

Troy.—The Snowstorm Mines Con. treated 4500 tons of ore in September. About 6000 is expected in October. Only 50 miners were employed last month, but 90 are there now. No. 7 tunnel is in 1000 ft. A motor-driven saw-mill has been erected.

NEVADA

Aurora.—The Aurora Consolidated, it is reported, will suspend operations at an early date. Under present conditions it is not profitable to mine the low-grade gold ore.

Las Vegas.—The manganese mine of T. Thorkildsen of Los Angeles, 17 miles from Las Vegas, is producing up to 200 tons per 24 hours. This quantity is to be doubled. Three shifts are employed. Seven White 5-ton auto-trucks and trailers and one 75-hp. Best tracklayer haul the ore to rail. One of the trucks is used for sprinkling and repairing the road. The trucks make four trips in 24 hours, delivering five tons each per trip; while the tracklayer delivers 40 tons, making one trip daily.

The State Railroad Commission at Carson has refused permission to the Las Vegas & Tonopah Railroad to discontinue operations. The company stated it was unable to operate at a profit and wished to tear-up its tracks. The Commission ruled that the road is a necessary link in the system extending from Canada to the Mexican border, that it is essential in rapid communications between northern and southern sections of Nevada, and that its passing would deprive Nye and Clark counties of taxable wealth. The Commission has made formal application to the U. S. Railroad Administration to take over and operate the line.

Rochester.—The Rochester Elda Fina Mining Co. brought suit against the Rochester Mines Co. for the sum of $1,056,000 in the District Court of Humboldt county on October 16, and levied attachments on the 17th on the bank-accounts, mining property, mill, and bullion of the defendant company. The suit is based on the plaintiff company's claim that the defendant has taken ore of that value belonging to the plaintiff, and will depend upon which company has the apex of the vein. Both companies claim to have the apex, and the dispute between them has been continuing for some years. The plaintiff bases the amount of its claim for damages on a figure of $15 per ton for the ore taken, it being said that rim samples return that amount as an average. The suit will not interfere with the working of the mine by Rochester Mines Co. L. A. Friedman is the controlling interest in that property, while Joseph F. Nenzel controls the Rochester Elda Fina Mining Company.

Tonopah.—Production last week totaled 8803 tons of ore valued at $149,651.

The Tonopah Mining Co. is fast cleaning-up its dumps. Its Millers plant treated 15,000 tons of this ore during September, yielding bullion worth $54,300. In 9 months the dumps have produced $468,000. From underground, daily shipments to the Belmont company's mill total 150 tons.

The West End produced $113,156 during September, making a total of over $1,000,000 in 9 months.

Bullion from the Belmont is worth about $1.20 per oz. The last clean-up for September yielded 88,460 oz. and 45 tons of concentrate. The latter is worth $500 per ton.

The Extension has its new pump at work in the Victor shaft.

The Halifax is raising from the 1400-ft. level to 1200 ft. to prospect an area of trachyte.

Production of some of the mines during September was as under:

Mine	Tons	Silver, oz.	Gold, oz.	Profit
Extension	8,379	94,392	898	$31,844
Tonopah Mining	14,350	113,700	1,122	45,910

The Mining company is experimenting on the tailing at its Millers plant, to see if it is worth re-treating.

The North Star company, A. E. Lowe in charge, reports that the drift under the Mizpah fault on the 900-ft. level has cut 3 ft. of good ore.

OKLAHOMA

Miami.—According to J. H. McNichols, another ore warehouse—50 by 500 ft.—is to be erected at Tar River. One of similar size will be put up at Douthat, where there are 44 producing mines. The one at Picher is expected to be ready by October 25.

Picher.—Production of the various districts last week totaled 6033 tons of blende and 977 tons of lead, valued at $424,150.

UTAH

American Fork.—The Belorophon mill is working steadily, but the Pacific mill has been closed temporarily, due to shortage of ore.

Garfield.—Sand-slides are said to have damaged the A. S. & R. smelter here to the amount of $75,000 or so, also tying-up work for a time in the crushing department.

Mammoth.—The Grand Central Mining Co. paid 4c. per share, equal to $24,000, on October 15. This makes $1,784,000 to date. Ore shipped in September amounted to 1350 tons.

CANADA

British Columbia

Atlin.—One of the best-known placer districts in British Columbia is Atlin, and probably there is no water-course better known to the local miners than Pine creek. The accompanying illustration shows part of the hydraulic workings of the Columbian Mines Co. This is of especial interest at present, because the holdings of this company, on account of high costs of labor and supplies, etc., and the low purchasing value of gold, were disposed of recently by the sheriff at a ridiculously low figure. The question of the company's title now threatens to become the subject of litigation in this Province.

C. E. Watson, the general manager of the Mining Corporation of Canada, and G. O. Randolph have gone to

HYDRAULICKING IN THE ATLIN DISTRICT, BRITISH COLUMBIA.

northern British Columbia. Their intention, according to well-authenticated reports, is to make a survey of the well-known Engineer gold mines of the Atlin district. The Engineer is at present controlled by Captain Alexander, who recovers considerable gold by means of a small stamp-mill. Several times the property has been under option for large sums.

This has been an exceptionally good season for water for hydraulicking in the Atlin region, but labor was very scarce, resulting in few of the creeks being worked to capacity. Generally speaking, the ground should yield an average output, but when profits are expected that is another matter. The high cost of supplies and the increase in wages, both past and prospective, will probably compel all to close down until conditions improve. There is only one company in this district that will make expenses this season, so it is little use in trying to operate under such conditions and exhaust the ground. The only relief is for the Government to give a bounty on the new gold produced, such bounty to offset the

increased cost of operating, which would amount to $8 or $9 per ounce.

Fernie.—After being on strike for 34 days the coal-miners at Crow's Nest Pass have returned to work. They are to work on the single-shift system, and the whole matter is to be investigated.

Princeton.—The Canada Copper Corporation is moving boilers and machinery from Phoenix, Boundary Falls, and Mother Lode to Princeton, where the 2000-ton mill is being constructed.

Ontario

Porcupine.—The Dome company, with 60 men, is developing on the 1250-ft. level, driving toward the east.

CHILE

Chuquicamata.—The Chile Copper Co. reports as follows for the first quarter of 1918: The net profit on copper delivered was $1,675,385. Deducting interest and bonds, $525,000 discount, etc., and adding sundry income, the net profit was $1,124,498. The cost of production, exclusive of excess profits tax, etc., was 18.38c. per lb., f.o.b. plant, including depreciation, 11.61c.; and delivered at Atlantic ports 14.39c. The leaching-plant treated 829,553 tons of 1.76% ore, making a recovery of 82.54%. The output was 24,876,498 lb. of copper, 940,000 lb. less than in the last quarter of 1917. There was 18,072,630 lb. sold at 23.83c. per pound.

Sewell.—Braden Copper Co. produced 6,020,000 lb. in September. This is the lowest yield since April.

MEXICO

Mexico

El Oro.—Directors of the El Oro Mining & Railway Co., in a report issued at London on September 27, state that the publication of the annual balance-sheet, etc., is undesirable at this time. The mine and mill worked at reduced capacity during the year ended June 30, 1918. Many difficulties hampered operations and increased costs. In March it was decided to work at full capacity, but this cannot be done for some time. Enough profit was earned to pay a dividend of 1s. (24 cents) per share, equal to £57,375 ($274,000). A. F. Main is general manager.

Sonora

Cananea.—Greene-Cananea produced 4,900,000 lb. of copper and 149,332 oz. of silver during September. This is almost equal to the past months output.

PHILIPPINE ISLANDS

Baguio.—The semi-annual report of the Benguet Consolidated Mining Co., for the period ended July 1, 1918, shows that the profit was ₱267,705. Three dividends, totaling 12½%, amounted to ₱125,000. A hoist, power-plant, head-frame, motor-truck, etc., cost ₱68,935. Contributions to Liberty Loans were ₱14,000. The period was one of construction and operation, little development of ore-reserves being done, save cleaning-out and re-timbering the old section of the mine, closed since 1909 and 1911. The mill treated 11,334 tons of ore, averaging ₱43.81 per ton. A. W. Beam is president, and C. M. Eye is superintendent.

TRANSVAAL

Cable advice on September 27 to 'The Financial Times' in London states that out of a complement of 1000 natives at the Village Main Reef mine, 213 are suffering from Spanish influenza; at the Ferreira Deep 299 out of 350; and at the City & Suburban 322 out of 2100. Ninety whites are affected at the same three mines. The outbreak is spreading to all mines. During September it is estimated that over 10,000 cases occurred, mostly among natives, but so far only one death has been reported.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Albert Burch was at Butte last week.

E. A. H. Tays, of San Blas, Mexico, is here on a visit.

Horace F. Lunt is at the E. O. T. S. Camp AA, Humphreys, Virginia.

John Linn is assisting **Morton Webber** in a mine examination at Mackay, Idaho.

Stuart Croasdale has changed his business address to 730 Symes Bdg., Denver, Colorado.

Augustus Locke, of Boston, is on his way to Washington, to join the Engineer Corps of the Army.

H. T. Matson passed through San Francisco on his return from Korea, going to Clarkdale, Arizona.

C. R. Miller, of the Tonopah Mining Co., has returned from a visit to the Mandy mine, at Schist lake, Manitoba.

Joseph Moore, superintendent for the Victor Power & Mining Co. for three years, has resigned and gone to Oakland.

R. G. Hall was delayed in sailing from San Francisco to Burma; he departed on the steamer leaving on October 18.

Lee O. Kellogg, mining engineer to the South American Development Co., at the Zaruma mine, in Ecuador, is at New York.

F. B. Weeks, of the U. S. Smelting, Refining & Mining Co., came from Salt Lake City to Berkeley, returning at the end of the week.

Tomizo Sasabe and **Zenkichi Nanase**, of the Mitsubishi Mining Co., in Japan, are visiting the mining districts of the United States.

Arthur S. Dwight, Major in the 11th Engineers, is at Marseilles, France, having been detailed to supervise metallurgical work.

F. N. Flynn has resigned as general superintendent for the Consolidated Mining & Smelting Co. of Canada and is now at New York.

Max J. Welch has returned from New York to Los Angeles until the first of the coming year. His address is 1210 Hollingsworth Bdg.

A. G. Haultain has been attached, with the rank of Captain, to the Engineering Unit of the Canadian Expeditionary Force to be sent to Siberia.

William B. McPhee, formerly superintendent for the Como Consolidated Mining Co., at Dayton, Nevada, has become general superintendent for the Dromedary-Hump Consolidated Mining Co. at Fairview, Nevada.

F. M. Smale, manager of the Portland mine at Cripple Creek for 23 years, has resigned. He rose from miner to manager. **G. M. Taylor**, the mill superintendent, succeeds him, to be in charge of all operations. Mr. Smale and wife left Colorado for a motor-tour through California, and will winter at San Diego.

C. B. Lakenan, manager for the Nevada Consolidated, Ely, Nevada, is leaving for Chile. **H. A. Guess** succeeds Mr. Lakenan. **C. V. Jenkins**, for many years business manager for the Nevada Consolidated, has been transferred to the New York office. **C. Zeigler**, who has been secretary to Mr. Lakenan for many years, is now business manager.

W. C. Grout, secretary to D. C. Jackling in his San Francisco office, died of pneumonia on October 15. He was well known by those that visited Mr. Jackling's office and his death at the early age of 34 will come as a shock and a cause of deep regret to many in the profession.

THE METAL MARKET

METAL PRICES

San Francisco, October 22

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound.	15
Copper, electrolytic, cents per pound, in carload lots.	26.00
Copper, electrolytic, cents per pound, in small quantities.	27.35
Lead, pig, cents per pound.	8.30—8.80
Platinum, Government price, per ounce.	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound.	11.50
Zinc-dust, cents per pound.	15

ORE PRICES

October 22

Chrome, no definite quotations available.

Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% Mo_2S	$1.25
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$26

Chrome: See pages 547 and 571 of this issue.

It seems for the present chrome is practically unsalable. Every buyer approached has the same answer: "that his requirements for the present year are fully covered under contract." No big business has been heard of in any direction, though sellers were perfectly willing to shade their prices.—Charles Hardy's weekly report.

EASTERN METAL MARKET

(By wire from New York)

October 22.—Copper and lead are unchanged. Spelter is quiet but stronger.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

Date	New York,	London,	Average week ending	
Oct. 16	101.12	48.81	Sept. 10	101.12
" 17	101.12	48.81	" 17	101.12
" 18	101.12	48.81	" 24	101.12
" 19	101.12	48.81	Oct. 1	101.12
" 20 Sunday			" 8	101.12
" 21	101.12	48.81	" 15	101.12
" 22	101.12	48.81	" 22	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.53	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date		Average week ending	
Oct. 16	26.00	Sept. 10	26.00
" 17	26.00	" 17	26.00
" 18	26.00	" 24	26.00
" 19	26.00	Oct. 1	26.00
" 20 Sunday		" 8	26.00
" 21	26.00	" 15	26.00
" 22	26.00	" 22	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Oct. 16	8.95	Sept. 10	9.41
" 17	9.00	" 17	9.62
" 18	9.05	" 24	9.76
" 19	9.10	Oct. 1	9.55
" 20 Sunday		" 8	9.31
" 21	9.15	" 15	9.02
" 22	9.20	" 22	9.08

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.87	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

Zinc-ore prices at Joplin, Missouri, were $2.50 per ton lower at $50, and the demand was lighter last week.

The weekly reports of the U. S. Geological Survey show that spelter production is decreasing slightly, while stocks are dropping 2000 tons per week.

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
Oct. 16	8.05	Sept. 10	8.05
" 17	8.05	" 17	8.05
" 18	8.05	" 24	8.05
" 19	8.05	Oct. 1	8.05
" 20 Sunday		" 8	8.05
" 21	8.05	" 15	8.05
" 22	8.05	" 22	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
Sept. 24	120.00	Oct. 8	120.00
Oct. 1	120.00	" 15	120.00
		" 22	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May.	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ORES (New York)

Antimony: No market in this ore here.

Manganese: Brazilian ore has sold at $1.20 per unit for 40 to 50% Mn content, at least 6000 tons having changed hands recently. This compares with as high as $1.35 to $1.40 per unit not long ago. The manganese-ore market is easing.

Manganese Alloys: The September output of these alloys made a new and phenomenal record, according to blast-furnace reports by 'The Iron Age.' American producers made over 66,000 tons, or an excess of 12,000 tons over best previous record. About 40,000 tons of this was spiegeleisen, also a record.

Molybdenum: No business is reported to have been done, with quotations nominal at $1.25 per lb. It could probably be bought under this.

Tungsten: A good demand is reported for the higher-grade ores, but a lighter one for the lower grades. Regular prices are said to be maintained at $25 to $26 per unit. The lower grades are quoted at $19 to $24 per unit. Peace prospects are said to have had little effect thus far. Ferrotungsten is reported to have been offered as high as $2.80 per lb. of contained tungsten.

Eastern Metal Market

New York, October 16.

The prospect of peace has had some influence in the markets generally, particularly those that are still 'open'; but all of them are quiet.

In copper circles there is little expectation of any change in price after November 1, due to international developments.

The tin market is exceedingly lifeless, and all concerned are awaiting official developments. No price has yet been fixed.

Lead is tighter than ever, but is being satisfactorily handled by the Lead Producers' Committee.

Zinc has fallen again gradually until it has nearly reached a cost basis, in the opinion of some producers. It is now steadying somewhat.

Antimony has declined and again exhibited a tendency to be firm.

In the steel trade, the sole topic has been the effect of a possible sudden ending of the War. It has, however, not been a disturbing factor. The general view is that, apart from shell-steel, some if which would probably be cancelled, the material now in the greatest demand would show no decided falling-off. Government shipbuilding would continue, and railroad equipment contracts would keep many mills busy for a long time. It is, however, conceded that in some lines an early peace would cause unsettlement and re-adjustment. The present Government price-fixing machinery is relied upon to stabilize the market for some time when war demand falls off. The dominant note in the whole industry, however, is the continued concentration of all effort on greater pig-iron and steel output. Steel-ingot output in September made a decidedly larger gain than that of pig-iron, companies representing 85% of the country's capacity producing 3,200,000 tons, or at a rate for the whole industry of 47,000,000 tons per year. The influenza epidemic has cut down output in eastern Pennsylvanian plants.

COPPER

As the time approaches for a decision on a new price for copper after November 1, the feeling is growing stronger that no change will be made and that the present price of 26c. will continue until the War ends. No reason appears to exist for a lowering of the price. It is felt by many that after price regulation ceases an advance will follow, because economical conditions will not alter quick enough to lower costs and because the present price is regarded as too low under present conditions of operation. It is said that a meeting to decide the price-level of the future will be held at Washington about October 23. Supplies of the metal are not regarded as ample by one authority, so great is the present demand for war purposes, and practically nothing is left for any small existing domestic use. Refinery production was interfered with quite considerably by the great shell-loading plant explosion of October 5 and 6 at South Amboy, New Jersey. At least two days' operations were cancelled because of this. The output is stated to be likely to fall off 10,000,000 lb. in October from this cause alone, and it has not been adequate for several months. An interesting published statement is to the effect that stocks of copper in Japan are increasing, and that producers there are unwilling to sell to European or American consumers at the fixed prices in those countries.

TIN

The actual tin situation is difficult to analyze; reports differ. A most reliable source of information states that there are as yet no definite official developments as to what has happened or what is to happen. It is the expectation of this authority that within the next week or ten days an announcement will come from Washington informing the whole trade, including importers, under just what conditions the trade will operate. Another authority says the control and allotment of the metal are now similar to copper and lead, but that no price has been fixed. It is a fact that the War Industries Board recently sent out a questionnaire to all dealers and users of tin, calling for a statement as to business done from June 1 to October 1, with replies to be in not later than October 15. Some definite statement will be a welcome relief to all concerned. As to general conditions, the market is dead and without interest. There has been no offering of future shipment tin for two weeks. There is some metal in transit and to arrive, and there has been limited offerings of this. Such sellers seem ready to make concessions on this metal for both positions, prompted by a desire to get from under before a price is fixed. The quotation for spot metal continues nominal at 81c., New York, with very little metal available. Tin arrivals in October, to the 9th, total 350 tons at Atlantic ports. The London quotation for spot Straits yesterday was £366 10s. per ton.

LEAD

The general situation is unchanged with complete control in the hands of the Lead Producers' Committee, which seems to be giving entire satisfaction, there being no objections recorded. The market is bare of inquiries, in fact all of them are probably handed directly to the Committee. The entire situation is tight. Agreed maximum quotations continue unchanged at 7.75c., St. Louis, or 8.05c., New York.

ZINC

The quotation yesterday for prime Western was 8.60c., St. Louis, or 8.95c., New York, for October or nearby delivery. The market has therefore continued to soften the past week until the foregoing level was reached. Today the tone is steady and stronger, due largely to prospective Government buying. The Army is to purchase 8000 tons of grade C, practically prime Western, for delivery in the last two months of this year, and the Navy is to buy 1000 tons for shipment over the next six months. Demand is light and the decline has taken place on small sales. It is not believed that any large sale could be put through at the present level of prices. Some state that the present quotations are down to a cost basis. For delivery in the last two months of this year the quotation is 8.25c., St. Louis, or 8.60c., New York. Some attribute the decline of the past two weeks to a prospect of peace. The weekly report of the Government, however, shows that the statistical position is strong with output and stocks decreasing. Stocks in the last week have fallen 1866 tons.

ANTIMONY

The market is lower at 13.62½c., duty paid, New York, for prompt and early delivery of wholesale lots. It is reported that several sales have been put through quietly. There is an inquiry of 3000 tons from the Government.

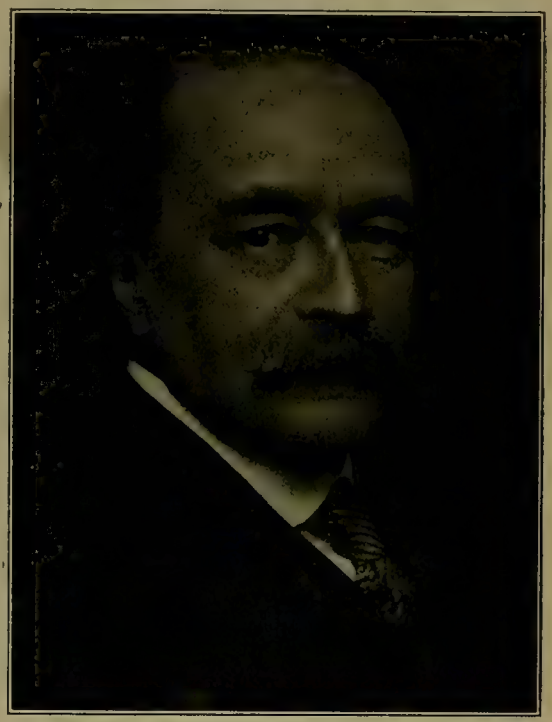
ALUMINUM

Government maximum prices control the market for No. 1 virgin metal, 98 to 99% pure, and for scrap at 33c. per lb. for 50-ton lots, at 33.10c. per lb. for 15 to 50-ton lots, and at 33.20c. per lb. for 1 to 15-ton lots.

Book Reviews

Incidents in the Life of a Mining Engineer. By E. T. McCarthy. Pp. 384. George Routledge & Sons, London; E. P. Dutton & Co., New York. For sale by 'Mining and Scientific Press'. Price, $4. Proceeds devoted to the maintenance of the St. Dustan's Hostel for Blinded Soldiers and Sailors.

This is an unpretentious recital of the varied experiences of a distinguished mining engineer, one of the veterans of the profession, with a memory of events that go back to the very beginning of mining explorations and developments in countries far apart. Mr. McCarthy is a graduate of the Royal School of Mines, London, but he served his apprenticeship in North Carolina, first as assistant-manager and then as manager of a gold mine among the 'Moonshiners'. He tells stories about them, about the 'darkies', the Southern white people, and his fight with a 'carpet-bagger'; indeed the first chapter is a good sample of the book, for it is full of interesting and amusing notes, all told in a conversational manner, without any attempt at literary finish, but full of human kindness and penetrating good sense. From the South he went to Denver, and from there to the Spanish Peaks, and back to Leadville, in 1879. He went on prospecting trips and acquired an interest in a promising claim. He tells about the Utes, about escapes from death in various guise, and something about the boom at Leadville. Those early experiences in America, he says, taught him much, widened his horizon, and made him keep always "a very warm corner in my heart for the U. S. A." The reviewer happens to know that in the expression of this sentiment, as in everything, he is sincere. Indeed, the lack of affectation of any sort pleases the reader continually; he feels complimented by being taken into the engaging confidence of a well-informed and much-traveled man. The next three chapters describe pioneer work in West Africa, in what is known as the Gold Coast, more particularly Wassau and Appolonia. Much of this has historic value, for it covers the very beginning not only of mining but of industrial development among the tribes of the interior. There is good fun in his story of an antic played by him at Monrovia, the capital of Liberia; there is scientific value in his description of the aboriginal 'lake-village'; and there is pathos in his sympathetic story of Bonnat's career. He had many 'close calls' during his adventures in the jungle and all kinds of strange happenings among the natives are described entertainingly. The author has some eminently sensible things to say about the climate of the Gold Coast and the methods for mitigating the enervating effects of it. Next he went to Morocco and then to Canada, in 1883. Mr. McCarthy sent the first cablegram from Calgary to Europe, and the first paid telegram to Winnipeg. He describes the building of the Canadian Pacific railroad and the opening up of the 'Great Lone Land'. He traveled on horseback, with companions picked up on the way, from Calgary through Montana to Vancouver. He inspected the coal mines; also the Drumlummon mine, if his reference to a mine not far from Helena is thus to be interpreted. At Victoria he saw the Krakatoa sunsets. From Vancouver he crossed the continent by way of San Francisco, Denver, and St. Louis to New Orleans, paying a visit to his former 'stamping-ground' in North Carolina before reaching New York, where he sailed on the old 'Celtic', not the later steamer of that name, and had the experience of a voyage that lasted 31 days from New York to Liverpool. The 'Celtic's' main shaft broke on the third day out, the screw would not turn or run loose, the vessel could not be steered, she was overtaken by a terrific gale, she was blown close to the Bahamas, the captain rigged her with sails, but on the 27th day the 'Britannia' came to the rescue and towed her safely to port. Mr. McCarthy had many other adventures, but this one is mentioned to prove his knack of getting into trouble, and of getting out successfully. When he started on his next journey of observation as a mining engineer the steamer on which he was traveling to Colon became crippled owing to a breakdown of the engines; the vessel drifting for six days before the engines could be re-started. It took 19 days to go from Plymouth to St. Thomas. At Port au Prince he had an adventure with predatory negroes, but the story cannot be compressed, so the reader of this review must read the book if he wants to enjoy it. At Colon he saw the French attempt to dig the Panama Canal under the De Lesseps company.



E. T. McCarthy

At that time Colon was a sink of sewage and iniquity. He describes it effectively; also the engineering difficulties that proved too much for De Lesseps, who was not an engineer, although his son was. He pays his tribute to the sanitation of the Canal Zone as carried out by the American administration and rates that accomplishment as high as the building of the Canal itself. He was now on his way to take charge of a gold mine in Nicaragua, in the hills beyond Leon. Three chapters are devoted to his two years' sojourn in that country. During most of this period a revolution was in progress, he had great difficulty in running the mine, he went through all sorts of bad quarters of an hour, yet he found time and inclination to admire the scenery, to be charmed by the natives, to study the life of the tropical jungle, to do many acts of kindness, and to possess his soul in self-respectful serenity. His descriptions of the queer ways of various animals and insects are intensely interesting; so are his analyses of the characters of the untutored mestizos. Just before leaving he witnessed the eruption of Momo Tombo and had a narrow escape both from violent earthquakes and volcanic ejectamenta. A short holiday in Switzerland and he was off again, to the Malay Peninsula.

While in the Far East the author was the guest of the

Sultan of Jahore, who gave him many kinds of curry, all spoiled by cocoanut milk. He had many amusing experiences and others that were disagreeable, as, for example, an encounter with a swarm of leeches while in the jungle on his way to a tin mine. This had been salted, as he ascertained by continuing to wash large samples, until the supply of 'salt,' that is, cassiterite, failed the vendor. Mr. McCarthy, in his anxiety not to talk shop, does not give the names of the mines that he visited or managed during the period covered by these reminiscences; that is a pity; for the giving of such information would have done no harm to anybody and would have heightened the interest of the book. A chapter is given to China and New Zealand. A mutiny on board ship and a night spent in the hold of another ship fighting rats are among the stories included. Then follow four chapters on Uruguay, where he was in charge of an unnamed mine and whither he brought his bride, the wife to whom he refers many times in the most touching terms. In that country, as elsewhere, he never missed anything that came his way, so that this part of the book is alive with interest. The last chapter recites his first experience in the Transvaal; it ends abruptly, as if the author had made up his mind that he had written enough, for the book covers only the happenings of 18 out of his 43 years of professional life as a mining engineer, and the reviewer knows that the later period includes much that would have been worth recounting. The book gives evidence of war-time by its typographic errors, especially in the spelling of names; it contains material that more carefully written and edited, with dates and names, would have constituted a volume of permanent value, and one can only regret that, having made up his mind to depart from the modest reticence habitual to himself, Mr. McCarthy should not have been a little more ambitious, instead of being satisfied to do what he set out frankly to do, namely, to write a book that he could sell in behalf of the St. Dustan's Hostel for Blinded Soldiers and Sailors. He has succeeded in his effort, for the book has sold well. We commend it to our readers both on its merits and for the cause to which it is dedicated.—T. A. R.

Company Reports

MODDERFONTEIN B GOLD MINES, LIMITED

Property: 1468 claims (1½ acres each), mines and mill on the Rand, Transvaal.

Operating Officials: C. L. Butlin, manager; H. Stuart Martin, consulting engineer.

Financial Statement: gold sold during 1917 realized £1,193,717 ($5,630,000), while expenses totaled £502,630 ($2,400,000). The profit was £709,601 ($3,400,000). Balance at Dec. 31, 1916, was £306,297 ($1,440,000), and that a year later £246,570 ($1,290,000.) Government taxes amounted to £82,503 ($394,000).

Dividends: two of 40 and 45% absorbed £595,000 ($2,860,000), making a total of £2,450,000 ($11,760,000) in six years.

Development: the labor supply was unsatisfactory, so new work fell off to 9941 ft. Of this, over 60% was in pay-ore. Reserves amount to 3,523,810 tons of $9.20 ore, an increase of 150,000 tons.

Production: an average of 96 stamps (80 gravity and 16 Nissen type) and 6 tube-mills crushed 517,500 tons, making a duty of 15.9 tons per stamp-day. Amalgamation and cyanidation extracted 94.7%, yielding 286,010 oz. of gold. Ore assayed $11.08 per ton.

Costs: all departments totaled $4.66 per ton, an increase of 38 cents per ton.

SEOUL MINING CO.

Property: gold mines and mills in Chosen (Korea).

Operating Officials: A. R. Weigall, consulting engineer and general manager; J. F. Mitchell-Roberts, assistant, consulting metallurgist, and acting superintendent of Tul Mi Chung; F. A. Oldis, auditor; G. C. Cranor, accountant Tul Mi Chung mine; Heiichiro Maki, consulting electrical engineer; S. Ishikuma, superintendent of electric power-plant; A. C. Mack, superintendent Suan mine; B. V. Barton, superintendent general development of Concession area; K. I. Yun, H. T. Matson, and F. A. Smith, in charge of development at Tong Ahm, Kung Kol, and Nau Chauri; J. H. Woolf, in charge of Peh Jai; Alex. McFarlane, Tul Mi Chung mine foreman; James Williams, Suan mine foreman; E. L. Blackwell, Tul Mi Chung mill foreman; H. B. Fields, Suan mill foreman; W. Guy B. Boydell, superintendent of ore estimation and surveying; D. W. Leeke, assistant to former; W. W. Barnett, chemist and assayer; C. S. Crowe, millwright and mechanical foreman; S. M. B. Aoki, Japanese assistant to general manager; and W. H. Minford, medical officer at Suan.

Financial Statement: the past two years compare as under:

	1917	1916
Total receipts	$1,698,417	$1,836,339
Operating charges	745,096	703,275
Interest on notes	75,833	79,375
Royalties and taxes	170,877	128,600
Depreciation	91,558	40,000
Profit	330,526	918,502
Dividends	255,500	250,000
Current assets	1,323,880	1,162,587
Current liabilities	202,277	173,881

Development: ore-reserves in the various mines total 816,957 tons, averaging $8.57 per ton, compared with 837,122 of $9.42 in 1916. The Suan mine is expected to be exhausted by the end of 1918. Tul Mi Chung contains 484,670 tons of $10.30 ore (gold-copper-silver), and Soctarie, 267,717 of $4.93 ore (tungsten-gold-copper). Tailing at Tul Mi Chung amounts to 180,000 tons, worth $2.78 per ton. The total amount of work done during 1917 was 31,312 ft., the greatest in any year. The cost of supplies was much higher than before.

Production: the milling results may be tabulated so:

	Suan	Tul Mi Chung
Ore treated, tons	65,844	149,195
Gross value per ton, gold and copper	$7.80	$9.94
Extraction, gold, per cent	87.43	56.87
Extraction, copper, per cent	86.98	89.64
Value of bullion	$274,306	
Value of concentrate	1,362,617	

Costs: these totaled $4.02 per ton, against $4.68 in 1916.

Metallurgy: there was added to the Tul Mi Chung mine a ball granulator and a Dorr classifier of the bowl type. While the recovery of copper is high, that of the gold is low. An immense amount of experimenting has been done to improve this condition, at the mine, in America, and in England. Tests completed indicate an extraction of 70% of the gold left in the tailing, with a cyanide consumption of 2.3 lb. per ton of tailing. For the present, this work will proceed, as the proposed 600-ton plant cannot be erected as long as existing conditions prevail. Cyanidation will supplement flotation. The total recovery of gold from the ore will be 85%, against 60% at present.

Another problem is the tungsten-gold-copper ore of the Soctarie mine. The valuable mineral is the 0.3% scheelite content. Separation of the concentrate into marketable products is the desired end, and this was fairly well solved. Twenty stamps of the Suan mill will be used for this ore, after certain alterations are made. In the 'Press' of October 5 the treatment of this ore was described as given in the annual report.

No mention is made of bismuth production this time.

INFORMATION FURNISHED BY MANUFACTURERS

THEORY OF GRAPHITE LUBRICATION

The theory of lubrication is to keep two moving surfaces apart. Metals are never smooth. Under a microscope the most highly polished piece of metal resembles a nutmeg grater. There are little pin-points sticking up, pores in the metal, tool-marks, and other irregularities. When the oil or grease squeezes out these irregularities interlock. This is the cause of friction. These little pin points also break; this is termed 'wear.' Tiny particles of metal in the bearing-parts act as an abrasive. Lubricating graphite overcomes this. It first fills the pores of the metal, after which it places a veneer over the wearing-surfaces. After the graphite veneer has been secured, friction will have been reduced to a minimum. Not only this, but the wear of the metal will be prevented, for the reason that the contact now is between graphite and graphite and not metal and metal. It is obvious that if metals do not rub together they cannot wear. To demonstrate this, take two small pieces of hard-faced paper. Lay one upon the other and try to move the upper piece over the lower one by applying weight and force. It is friction that holds the two pieces of paper together. Now take some fine flake graphite and run a little on each piece of paper, place the graphited surfaces together, and do the same as before. Now the papers will move readily one upon the other.

Again, take one piece of paper, on the corner of which is no graphite, and rub it upon the other graphited piece, in all directions, to work the graphite thoroughly into the paper. Look at the paper and you will observe that the graphite has filled the pores, and has placed a veneer over the surface. Lay the two pieces of paper together and rub as before, placing weight upon it, and you will find that the more weight applied, in other words, the more work the flake-graphite is given to do, the easier it moves, and, unlike oil or grease, it does not and cannot be squeezed out from the point of contact. It gathers at the point of contact until it has filled the pores and irregularities in the paper. This test illustrates that, irrespective of weight, a film of graphite cannot be squeezed out. The more weight applied, the more firmly is it embedded in the metal, and the smoother the surface becomes.

WALWORTH STILLSON WRENCH

With the idea of releasing labor, and conserving material and fuel, the **Walworth Mfg. Co.**, of Boston, has, at the urgent request of the War Industries Board, adopted as a war measure, the following: (1) We will discontinue the manufacture of the 6-in. genuine Walworth stillson-wrench. (2) We will discontinue the manufacture of the wood-handle genuine Walworth stillson wrench in all sizes, making only the steel handle. (3) We have adopted the 'war finish' as the standard finish for genuine Walworth stillson-wrenches for the duration of the War. No change whatever has been made in patterns or quality of material or workmanship in the wrench proper. A tag will be attached to each wrench, giving the reasons for the change to 'war finish' standard. Although the 'war finish' wrench presents a rougher appearance, it is the same sturdy, dependable tool that it has been for nearly fifty years.

COMMERCIAL PARAGRAPHS

The Electrical Alloy Co., Morristown, Pennsylvania, has filed plans for the construction of an addition to its plant.

The Metal Alloys Co., Albany, New York, has increased its capital from $100,000 to $500,000 for extensions and expansion.

The Chicago Pneumatic Tool Co. announce the appointment of B. H. Tripp as district sales-manager for the Pacific Coast territory.

The Illinois Zinc Co., La Salle, Illinois, has completed plans for the erection of an addition to its plant to cost about $400,000.

The Newark Bay Smelting & Refining Co., Plum Point Lane, Newark, New Jersey, has filed plans for the erection of an addition to its works.

The Radium Luminous Material Corporation, Orange, New Jersey, has filed plans for the erection of an addition to its plant on Alden street.

The Levin Graphite Co., Ashland, Alamaba, recently incorporated with a capital of $100,000, is planning for the operation of graphite properties in this vicinity.

The Badger Mining Co., Joplin, Missouri, has awarded a contract to Edgar Foster, of Joplin, for the construction of a new concentrating plant at its works near Joplin, to cost about $56,000.

The Empire Silica Co., Wilmington, Delaware, has been incorporated with a capital of $100,000 to operate silica mines. F. A. Armstrong and M. M. Clancy, Wilmington, are the incorporators.

Charles A. Foyer & Co., of Cleveland, Ohio, manufacturer of typewriter ribbons and carbon paper, announces a prepaid mail-order and express-delivery department at prices that represent a great economy.

The Penn Electric Smelting Corporation, New York, has been incorporated with a capital of $100,000 to operate a smelting plant. W. W. Gephart, C. Batchelor, and D. P. Earle, 165 Broadway, are the incorporators.

The Metallurgical Chemical Corporation, New York, New York, has been incorporated with a capital of $50,000 to manufacture chemicals of various kinds. R. J. Eddy, C. R. Allison, and A. M. Skivens, 111 Broadway, are the incorporators.

Zelnickers Bulletin No. 247 covers a wide range of ready-to-ship equipment, especially in the line of railway rolling stock, for standard gauge, 36-in., 30-in., and 24-in. gauge. It also lists steam-shovels, ditchers, air-compressors, and machine-shop tools.

The United States Steel Corporation, Ordnance Department, is planning for immediate work on its proposed new gun and projectile plant for the Government at Neville Island, Pittsburgh. The contract has been awarded to the **Illinois Improvement & Ballast Co.**, Chicago, at a price of

$6,000,000 for grading, excavating, concrete foundations for buildings, and other work to get the site ready for the new structures. The ordnance plant will occupy an area of about 400 acres.

The National Fluorspar Co., Union City, Tennessee, recently organized with a capital of $100,000, is planning for the development of about 200 acres of property near Ida, Kentucky. Machinery and equipment will be purchased for the new works. W. D. Fry is president of the company.

'Westinghouse Investments and Relays' is the title of Catalogue 3-B, issued by the **Westinghouse Electric & Manufacturing Co.**, a handsomely illustrated volume of 103 pages, dealing with electric measuring equipment and laboratory devices. It supersedes the Catalogue 3-B issued in July 1916.

The Commercial Electrolytic Corporation, 111 Colgate avenue, Buffalo, New York, manufacturer of ammonium persulphite, and general chemicals, is considering the construction of a new plant for increased output. The company has recently completed the erection of a plant in the South Buffalo Terminal district.

The Mineral Corporation of America, Inc., 42 Broadway, New York, is planning for the development of feldspar properties in North Carolina. The company is now operating the property, in part, for the chromite, and it is understood that new machinery and equipment will be purchased for the proposed new extensions.

Boiler-pitting. An English engineer reports that he had used suspended pieces of zinc to counteract the tendency of boiler-pitting, but with mild-steel boilers it was ineffective, because of the large percentage of carbon in the steel. Pitting had been prevented by cleaning off the scale and painting with a weak portland cement solution.

Coal mines in Brooke county, West Virginia, will be developed by the **Electric Mining Co.** of Wheeling. This company is planning extensive development and mining work, and, it is understood, will soon purchase machinery and equipment. The company has a capital of $1,000,000. Frank B. Ball, Plainfield, New Jersey, heads the organization.

Zelnicker's Bulletin, No. 249, just issued, lists five 91-ton Baldwin locomotives, thoroughly over-hauled and renovated, so as to pass the Federal requirements. There are also on hand, ready for immediate delivery, four Marion and two Bucyrus steam-shovels, from 1¼ to 4-cu. yd. capacity, and a number of small traction steam-shovels. The list includes gondolas, flat-cars, and other rolling-stock.

By agreement with the Government, the **General Electric Co.** is conserving its stock of materials and finished products for direct and indirect Government requirements, and has only slight discretion in the matter. If you favor the company with your order, and it is for Government work, give the name of the first contractor, the Governmental and Departmental order-numbers, and the Priority-Certificate numbers if any. If not for Government work, state the name of the ultimate user, the character of the product, and the relation of this material thereto. It is essential that the above information be furnished before your orders can be entered and executed. For your convenience the company will send blank-forms upon which the required information may be transmitted.

The high board fence surrounding the property of the East Butte Copper Mining Co., Butte, Montana, and also its wooden buildings, were painted with **Dixon's** silica-graphite paint in 1910. They have had eight years of service. E. D. Pratt, purchasing agent for that company, a real efficiency man, told W. H. Wanner, representative of Dixon's San Francisco sales office, that we could use his name and refer to this excellent service of Dixon's silica-graphite paint on his plant as an example of the fact that it is an excellent protective paint for wood or metal.

The word 'Angelus' brings to mind the beautiful masterpiece by Jean François Millet, but the 'Angelus' of present times is a rude contrast to this. Its weird, penetrating screech call to halt the rush of business for a brief prayer for the success of the Allied arms. Patriotic Christian people throughout the country are furthering the Angelus movement. To apply the idea, there was needed a signal louder and more distinctive than ordinary bells or whistles. The Federal Electric Siren was the one that filled this requirement. They have been mounted on the tops of tall buildings in Washington, D. C., and in St. Louis, the two largest cities which so far have taken up the movement. The instrument is identical with the one generally used as a fire warning, and by mines and industrial plants as starting, quitting, and emergency signals. Federal sirens are manufactured and installed by the **Federal Sign System (Electric)**, Lake and Desplaines street, Chicago, and are advertised elsewhere in these pages.

Arthur Lamotte, manager of the technical division of **E. I. du Pont de Nemours & Co.**, writing on the cause of burnt-out charges of powder, commonly called 'stinkers' in miners' parlance, says: "One of the most prolific causes of this condition is lacing the fuse through the dynamite cartridge, or inserting the fuse and cap so deeply in the dynamite cartridge that part of the dynamite burns before the spark from the fuse reaches the blasting-cap. It must be remembered that in a bore-hole, under strong confinement, dynamite burns much more rapidly than it does in the open air, and it is possible for a considerable amount of dynamite to burn before the cap explodes. There is no doubt that the storage of explosives in tunnels or 'dugout' magazines has a most deleterious effect, as any kind of explosive loses a great deal of its strength when subjected to the humid atmosphere encountered in these places. The more moisture absorbed by the dynamite the less sensitive it becomes, and the more chance there is of a mis-fire. Storage of blasting-caps in a damp magazine is even more likely to cause trouble, as a weak blasting-cap, into which moisture has penetrated, will frequently ignite only the dynamite and not detonate it. A dugout or tunnel-magazine is an extremely expensive proposition, as any explosive left in it for even a few weeks will lose a great deal of its strength, so that while the operator may have paid for 40% dynamite, he may not realize more than he would out of fresh 25% dynamite. The expense in maintaining such a magazine can be readily calculated. In the matter of handling of fuse there are two points worth considering: one is that any tool used for cutting fuse should be of such construction that the blade gives a shearing-action on the fuse. A pinching-action is liable to smear the waterproofing compound over the powder core. The principal manufacturers of explosives have developed a very efficient combination crimping and cutting-tool which gives a perfectly clean cut. Where a large number of lengths of fuse are cut every day, about the best implement one can use is a pair of high-grade pruning shears made so that the blade can be taken out and sharpened from time to time. Any fuse-cutting tool should be cleaned every day with gasoline to prevent the waterproofing compound from gumming it up and preventing a clean cut. The fuse should be cut straight across, not at an angle, because the sharp point is not only dangerous to insert into a blasting-cap, but allows an air-space between the end of the fuse and the cap-composition, which may become filled with carbon di-oxide gas, preventing the end-spit of the fuse and acting as a fire-extinguisher on the flame. As the powder in the fuse-core is somewhat susceptible to moisture, only enough lengths of fuse should be cut for the day's work. These lengths should be stored in a dry place, and not taken into the mine until shortly before they are to be used."

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Edited by T. A. RICKARD

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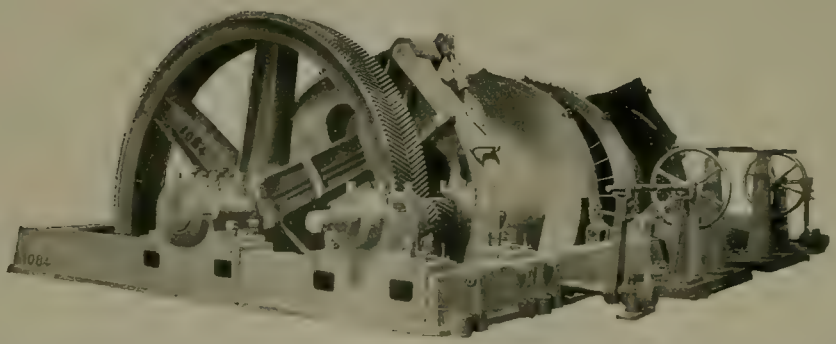

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C. T. HUTCHINSON, Manager
E. H. LESLIE, 600 Fisher Bdg., Chicago
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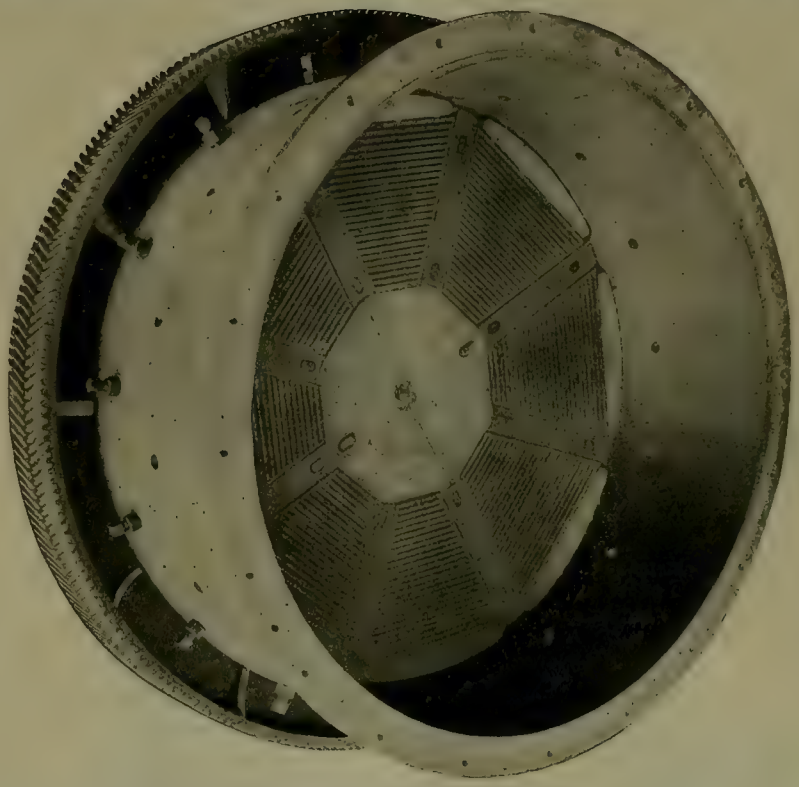

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COPPER to the amount of 1258 million pounds was used by the United States and her Allies in the first seven months of the current year, the consumption of the United States during that period being more than double that of England, France, Italy, and Canada combined. The supply of refined metal in the United States during the first half of the year is estimated to have been 1401 million pounds, the apparent domestic consumption being 950 million pounds.

ACCORDING to the 'Financial Times', of London, the coal deposits of Spitzbergen, to which we refer elsewhere in this issue, were discovered by a Scotsman named Lamont in 1870, but no serious work was done until Mr. John M. Longyear started operations in 1905 in the name of the Arctic Coal Company. During the past summer another company, the Norwegian Spitzbergen Company, shipped 40,000 tons of coal from Green Harbor to Norway. Next summer, given favorable conditions, it is expected that 100,000 tons of coal will be exported from Spitzbergen.

CHEMISTS are in such demand that the Chemical Warfare Service of the United States Army has requested all men having had any chemical training or experience to fill out questionnaires that will be sent them on application. For the coming year 4000 chemists are urgently needed. Half of these are required by the Government and half for private enterprises. The Research Council, at the request of the War Department, has drawn plans for the education of young men by intensive training in chemical engineering to supply the pressing need. One group will be given a course lasting one year, a second group will be trained for two years, and a third for three years, before being inducted into service. These courses will be given partly in connection with the Students Army Training Corps.

UPON another page we publish this week a short, but timely and interesting, article on 'Mining in Russia' by Mr. Herbert C. Woolmer, formerly manager of the Spassky copper mine, in Siberia, and associated as mining engineer with other important enterprises in Russia before the Bolshevik disruption. Mr. Woolmer gives an idea of the paternal functions necessarily assumed by many companies in the former Tzardom and thereby suggests the havoc made with the internal economy of the country when the revolution destroyed the management of such enterprises. We are glad to give our readers this first-hand information and hope that Mr. Woolmer will find time to write for us again, because among the members of the profession in the United States there are many men keenly interested in the resumption of mining operations in Russia.

WIDESPREAD sorrow has been evoked by the sinking of the Steamer 'Princess Sophia' in the Lynn Canal, near Skagway, Alaska, during a storm in the night of October 25. This vessel, belonging to the Canadian Pacific Railway, was on her home voyage and was bringing with her 343 passengers, including a large number of men conspicuous in the mining industry of the Yukon and Alaska. All are reported lost. We note with particular regret the drowning of U. G. Moore, formerly U. S. Commissioner at Eagle City, John F. Pugh, U. S. Collector of Customs at Juneau, E. S. Ironside, Collector of Customs at Dawson, Walter Barnes, Jack Chisholm, George Milton, S. J. Baggerly, besides a group of men on the staff of the Yukon Gold Company, notably J. R. Young, T. E. Thorson, A. R. McLean, and Frank Brown. A large number of steamboat captains and river-men were on board from vessels now laid up for the winter. Many of these were well-known and much liked by the nomadic miners and mining engineers of the North. The passengers on this ill-fated vessel were coming 'out' at the close of the active season and were anticipating the happiness of rest and comfort after hard work. It appears that the steamer ran aground during the storm and that either it was deemed safer to remain on board or that an attempt to disembark in the boats was made too late. The disaster is deeply to be deplored.

WE note that the Treasury department of Great Britain has appointed a commission to investigate and report on "the War's effect on gold production in the British Empire." This commission is empowered to go thoroughly into the question of mining low-grade ores and to inquire how far, from the national standpoint, it may be considered important to ensure the continued exploitation of such ores; it is also asked to suggest a plan for stimulating the production of gold. The four members of the commission, under the chairmanship of

Lord Inchcape, will have Mr. William Frecheville as their technical adviser. Meanwhile the chairman of the Transvaal Chamber of Mines, Mr. E. A. Wallers, has stated that out of 49 companies now operating in the Transvaal, six are running at a loss and fifteen are operating close to the economic margin; if these 21 companies should be compelled, by force of circumstances, to cease their operations, the effects would be disastrous, not only in the Transvaal but in England. A decrease of $6,500,000 in production is recorded in the Rand output for the first eight months of this year. Here we may quote the remark made recently, at a bank meeting in London, by Sir Edward Holden, a highly respected authority on finance: "There will undoubtedly be a great demand for gold after the War, and when the South African gold is again offered for sale in London we should at all costs retain it in this country, and not allow other countries to take it from us, as was done before the War." It is interesting to observe the increasing interest in the subject at London; we trust that no less interest will be manifested at Washington, for the subject is one that concerns, not only the gold miner and his backers, but every citizen zealous of the national welfare.

MANY guesses have been made at the extent to which the cost of living has increased, but accurate data are difficult to obtain. The subject is of such significance, viewed in its relation to wages, that the National Industrial Conference Board undertook to analyze the statistics in possession of the Government bureaus, and to gather additional information. The conclusion reached is that the average increase in the family budget for the year ending June 30, 1918, over that for the fiscal year 1913-14, has been approximately 52%. On a classified list of items, the increases are as follows: food 62%, rent 15%, clothing 77%, fuel and light 45%, sundries 50%. No great variation in the elevation of prices was found to exist between the cities of the East and the West. As invariably happens when the trend of prices is upward the heavier burden falls upon salaried employees. Wages are more sensitive, since the cost of manufactured goods generally consists in large part of the outlay for labor; moreover, the facilities for transportation, as compared with those available at the time of previous crises in our history, have so relieved the working classes from the restraint of immobility as to enable them to take the utmost advantage of competition for their services. Consequently wages have risen in greater proportion than the advance in prices. This is true even with respect to foods, in the cost of which the element of labor enters to a smaller degree. Because of this the prices of food should increase more slowly, but our unscientific methods of distribution offer larger opportunities for profiteering in this branch of commerce. Government regulations will probably reduce the prices of such articles, but rents are expected to advance on account of higher taxes and increased insurance. In view of the foregoing it would appear that a large proportion of the miners, who are protected in many Western districts against unjust food prices, and are also provided with quarters at modest rates, have benefited by the prevalent high wages more than the workers in shipyards and factories, despite the alluring sums that are paid for labor in those industries. It is in the crowded centres of population that the workman is exposed to the worst evils of profiteering; the miner has a better chance to save money against the days of financial stringency that are sure to follow the War.

The Prospect of Peace

These are epoch-making days; at any moment the telegraph may bring news affecting the welfare of the world for generations to come. It is a time for mental restraint and judicial temper, for we are as much at the parting of the ways at this climax of our successful military campaign as we were at the beginning of the War four years ago. The exchange of notes between the President of the United States and the German government has brought the belligerent nations to the point where hostilities may cease suddenly by the surrender of the Enemy's armies or they may be continued with increased bitterness for many months into a spring campaign next year. With these alternatives is involved the sinister possibility of disagreement between the Allies. That possibility is unlikely and it is mentioned only in order to lay stress on the need for a maximum effort to preserve mutual goodwill and continued whole-hearted co-operation such as are ensured only by moderation of statement and emotional constraint. This is not easy, for each belligerent feels his own hurts and is inclined to demand particular reparation for them in preference to the vague aspirations for such international reorganization as is foreshadowed in the proposal for a league of nations after the War. The present absorbing crisis was started by the German note of October 6, itself the immediate consequence of the splendidly successful offensive of the Allied armies under Marshal Foch, begun in the middle of last July. The first German note conveyed a desire to negotiate on the basis of the program enunciated by the President on January 8—the celebrated Fourteen Terms —and requested an immediate armistice, or cessation of fighting. To this the President replied, on October 8, that no armistice was possible unless the Enemy evacuated all the invaded territory. He also asked whether the German Chancellor was speaking for those heretofore responsible for the conduct of the War or for a newly constituted authority in Germany. Four days later, on October 12, the German Secretary for Foreign Affairs declared Germany's readiness to comply with the terms and principles laid down by the President and asserted that the Chancellor spoke with the support of a majority of the Reichstag and in the name of the German people. To this the President replied on October 15, declining to consider an armistice so long as the armed forces of Germany continued their illegal and inhumane methods, and unless satisfactory safeguards were provided for the maintenance of the present military supremacy of the Allies. At the same time, he asked for proofs that the

German government had emerged from the control of arbitrary power. On October 20 the same Secretary of State responded from Berlin by stating that orders had been given to stop the torpedoing of passenger ships, but the acceptance of the condition for the evacuation of occupied territories was obscured by the mention of steps for the safeguarding of the "actual standard of power of both sides in the field;" it was denied that lifeboats with passengers had been purposely destroyed by submarines, and reference was made to plans for altering the constitution of the German empire. To this the President replied promptly, on October 23, reviewing the correspondence and stating that he had transmitted it to the governments of the Allies, asking them to decide whether an armistice should be granted and, if so, on what conditions. He deemed it necessary to say that the German Foreign Secretary, speaking for the Chancellor, had not as yet given proof that "a government responsible to the German people" had been established or that the changes indicated were of a permanent character; therefore he said plainly that the nations of the world could not trust the word of those hitherto the masters of German policy, that the power of the King of Prussia appeared still to be unimpaired, and that the United States could not deal with any but veritable representatives of the German people; finally, that if it must deal with the military masters and monarchical autocrats of Germany, then it demanded not peace negotiations but surrender. Another note is said to be on its way from Berlin, assuring the President that "far-reaching changes" have been made in "the constitutional structure" of Germany, making the military powers subject to civilian control; and that the German government is awaiting proposals for an armistice. Meanwhile Mr. E. M. House, as personal representative of the President, has arrived at Paris, where he is to meet Messrs. Lloyd George and Clemenceau. The military and naval representatives of the United States are preparing to attend a meeting of the Supreme War Council of the Allies at Versailles. Many forecasts of the terms for an armistice have appeared, but they are only unofficial guesses and therefore negligible. We must possess our souls in patience, reposing full reliance in the sagacity of the Council, which, guided by Marshal Foch, knows exactly what the circumstances require. Public utterances in this country, in England, and in France indicate the stern resolve of the Allied nations not to be fooled by German trickery, and, above all, not to allow the German overtures to weaken the purpose or disarrange the plans of the Allies. Undoubtedly the military masters of Germany had hoped to repeat the effects of their peace offensive in 1916, which demoralized the Allies and very nearly led to disaster. So far no convincing changes have been made in the system of government at Berlin, all that has been indicated in the successive German notes amounting only to steps in the desired direction, all of which could be swept aside by the Kaiser, who still remains at the head of the army and navy, of the administration, and therefore still controls the destiny of the German people. The same Secretary of State is in office. One notable change is the omission of the word 'imperial' when designating the government of Germany. The record of the latest Chancellor, Prince Maximilian of Baden, is not one to inspire confidence in his sincerity. Mr. Maximilian Harden, of the 'Zukunft', appears to be the better spokesman for Germany in her distress. The protestations against the charge of inhumane actions and the promise to discontinue them have been followed recently by the exposure of German practices in the cities from which they have been driven and by a large volume of bitter denunciation of the looting, destruction, and savagery—far outside the limits of ordinary warfare—to which Belgium and northern France have been subjected in the course of the German retreat. Of course, it may be difficult suddenly to curb the frightfulness to which the German officers and soldiers have been trained, but it is certain that the persistence in such behavior, in the face of unctuous assurances from Berlin, is having a bad effect on the temper of the Allied peoples. It does seem, however, as if the acceptance of the President's terms represented an acknowledgment of military failure, and a real effort to end the War, so as to prevent the complete consequences of defeat, among which the destruction of the Hohenzollern dynasty stands pre-eminent. There is the crux. The military masters of Germany, with the King of Prussia at their head, will try to save their faces and will hope to the last minute to continue in control of the German government, whereas the President speaks the minds of all the Allies when he insists that the granting of an armistice shall be dependent upon either the unhorsing of the Kaiser and those responsible for the War or a complete surrender of the German armies, as a preliminary to peace. In any event, no negotiations for peace are to be tolerated until the Enemy lays down his arms, for we know well what the alternative means; mere talk while manœuvring for a better military position. The German press has given signs of considering the acceptance of the President's terms as the basis for further negotiations. They will be undeceived shortly. The Allies are acting in unison, without any signs of the slackening of purpose caused by the German peace offensive of 1916. It has been interesting to observe the keen anxiety expressed, as each German note has been published, lest the President should play into the Enemy's hands. It was recognized that he was dealing with an outlaw, and that he might place himself under obligations without obtaining any satisfactory guarantees from a government that had shown no regard for either its contracts or its word. As each note was answered, dexterously, by the President, a sigh of relief could be heard both here and in Europe, and when his last note, concluding with its blunt reference to the King of Prussia and surrender, was published, there was a world-wide gesture of enthusiastic approval. Fears have been expressed that the President might not consult our Allies sufficiently, causing complications thereby, but it may be assumed confidently that each of his notes has been based upon previous consulta-

tion with the representatives of the Allied governments at Washington and upon telegraphic conversation with the heads of these governments in Europe. Now the President, having conducted the diplomatic correspondence to a definite conclusion, has referred the question of an armistice to the supreme military authority of the Allied nations, namely, the Council at Versailles. A decision will come in due course, after proper deliberation, for it is obvious that the Allied military command is in no hurry to cease its successful offensive, whereas the German Headquarters Staff is impatient to call a truce for fear the retreat of its armies should become a real rout. General Ludendorff, the supposed organizer of victory, has resigned, thereby confessing his inability to stem the tide that now is overwhelming the Prussian's vainglorious dream of world-dominion. Not 'dominion' but 'downfall' is the verdict of events. It is clear therefore that we stand on the threshold of a momentous decision. If the German government—whatever it may be—accepts the terms of the armistice to be announced by the Supreme War Council of the Allies, then the War will be at an end and a period of intensely complicated political readjustment is at hand.

The Chrome Scandal

Responding to the initiative of the Californian chrome producers in organizing a protective association, the chrome miners of Oregon have done the same thing. A meeting of more than twenty operators was held at Grants Pass, Oregon, on October 22, resulting in the formation of the Oregon Chrome Producers Association, of which Mr. F. S. Bramwell is permanent chairman, and Mr. O. S. Blanchard, secretary. By unanimous vote affiliation with the Pacific Coast Chrome Producers Association will be effected at once. Thus a solid front will be presented in bringing before the proper authorities at Washington the facts regarding the collapse of the chrome industry. One interesting feature of the conditions that have wrought such financial hardships upon miners in Oregon is that the majority of the deposits being worked by them are relatively low-grade, lying within the limit of the products assigned for use as a refractory material. That limit has been raised from 38 to 43%, and in one instance a special ruling has been made for the benefit of a powerful steel corporation to permit the sale of a cargo of 45% Cuban ore to a maker of refractories. It is interesting to note that a special ruling, explicitly limited to one particular shipment, should have been considered appropriate in order to save a rich corporation from financial loss, but no ruling has yet been made to allow the ore of the poor miners, whose losses mean financial ruin to them, to be purchased by the manufacturers of refractory supplies. On the justifiable plea of a scarcity of chrome the Government fixed a maximum tonnage as well as a maximum grade of ore that might be used for refractory purposes during the current year. The quantity thus allocated is insufficient, and the refractory trade could immediately consume much larger amounts, but the War Industries Board has not permitted the absorption of the ore that is offered. Indeed, much higher-grade ore could be consumed advantageously, but the restrictions as to tonnage and grade remain unchanged, while the miner is being crushed for want of the very market that would take his output if suffered to do so. We do not object to a great steel company being granted permission to dispose of its product at a profit, nor do we protest against a ruling that averts a loss of money, no matter how many millions the beneficiary already may possess, but the discrimination of the War Industries Board in favor of a rich corporation while remaining deaf to the petitions of the poor producers who were urged by the Government to undertake this peculiarly venturesome business as a patriotic duty is a wrong that the Government cannot allow to go unrighted. The statistics of past production show how carefully the miner had left chrome alone; he understood perfectly that our needs could be met by imported ores at a cost lower than was possible here. The Western prospector and miner is not a visionary; he may entertain dreams of some day finding the mine that will reward with riches the years of rough work and constant hardship; that does not prove him unworthy of consideration at Washington, nor does it argue against the good sense of local bankers and capitalists that they assist such men to finance a chrome mine at a time when the country's officials were pleading with them to produce this essential of war. In normal times they would not have financed a chrome mine, nor would they have done it on the hope of increased prices due to war; they did it because they had faith in their Government, faith in the party in power, faith that the committees appointed to attend to the business of providing munitions were amenable to the President who was leading us in a war for democracy and clean government. They have faith in him still, and they do not believe that the Administration, and the public that sustains it, will permit corporate greed to defraud the miner of his rights when once the facts are made known. When it is clearly understood that a little longer delay in recognizing the obligation of the Government toward these men, who risked all they had in producing chrome ore at its behest, will crush them so that they can never resume, and when it is made clear that corporations have accumulated large stocks of ore in order to unload them at exorbitant prices, free from competition, then, we feel assured, public opinion will be aroused to prevent the perpetration of the wrong. These machinations to rob the plain people cannot resist the light; they can flourish only under the cover that shelters oligarchy. This is counter to the spirit of the age, counter to the spirit of the Government, and we may be certain that a Teutonic system of cartels, greedy and grasping, and opposed to the democratic distribution of opportunity, will not be permitted to give the lie to all the fine things we are undertaking to do for the establishment of free and honest government throughout the world. Reform, no less than charity, gains grace by beginning at home.

The Utah Copper Enterprise

The Editor:

Sir—In your third installment of the 'Utah Copper Enterprise' I find much of personal interest to myself, and I desire to call your attention to some matters that in a way will be news to you, but nevertheless facts. In the summer of 1881, while *en route* from Denver to Rosita, Colorado, I took passage on a stage-coach at Canyon City, going to Silver Cliff. My fellow passengers were Henry M. Teller, Capt. J. R. DeLamar, and Edmund Edyvean. Certainly the right combination for a new country: Senator Teller, I was acquainted with, for I had met him in 1868 at the office of Teller & Orahood, Central City. Mr. Edyvean I had met at Dodgeville, Iowa county, Wisconsin, where he was engaged in the smelting business. He had a small Scotch furnace; a number of them were successfully operated in that lead district of Wisconsin. Edyvean introduced me to Captain DeLamar, and I, in turn, introduced them to Senator Teller. General conversation followed and during the all-day ride we became well acquainted. I learned that DeLamar was taking Edyvean to the Terrible mine for the purpose of building a smelter. I became interested at once, and before we reached Silver Cliff, DeLamar invited me to go with them to the mine. This, I understood, was the first mining venture for DeLamar. His associates were the Wahl Bros. of Chicago. The mine was operated at a good profit and when developed sufficiently to warrant a steady production was sold by DeLamar to the Omaha & Grant Smelting & Refining Co., the Captain taking his share of the profits and going to Silver City, Idaho. There he purchased some prospects and opened up the famous DeLamar mine and operated it at a profit and finally sold it to foreign parties.

In 1893 Capt. DeLamar arrived in Durango, Colorado, accompanied by James Healey, a mining man from Nevada. I met him and we proceeded to the Montezuma mine in the La Plata mountains for the purpose of examining the same. Arriving there, I was instructed, first to examine the surface openings scattered over the property. DeLamar and Healey sampled the main incline and drifts. Some hours after, I was instructed to sample the incline and drifts. The Captain and Healey left for Durango and Denver before I completed my work. When I finished my work I had the samples tested at the Durango smelter, wired the returns to the Captain at Denver and heard nothing from him till after he reached New York; when I was informed the results obtained from my sampling corroborated his own work.

In 1894 I received a telegram from him to go to Denver and inquire for a letter of instruction at the office of Pierce & Smith. The instructions were to go to the Cripple Creek district and take samples from any good-looking property that was offered for sale and report my findings to him in New York. I was also instructed to take my samples for assay either to E. E. Burlingame of Denver, or to the works managed by Charles MacNeill at Victor. After taking samples from the Gold Coin mine—then 60 ft. deep—and several other properties, I went to MacNeill's office with my letter of instruction and the samples, and was introduced by MacNeill to D. C. Jackling, assayer and chemist, who made the tests on all the samples I cut in that district.

Returning to Denver, I found letters with instructions to proceed to Salt Lake City, to find A. N. Butts, owner of the Golden Gate mine at Mercur, Utah, examine that property, and send my report to New York. I made a thorough examination, had the samples tested by R. H. Officer & Co., sending duplicates either to Burlingame or MacNeill; telegraphed results to Capt. DeLamar, who wired me he was leaving for San Francisco the next day and would meet me at Salt Lake.

We met there, as per arrangement, and went over the maps and assay-sheets, and the next day proceeded to Mercur. Descending the shaft to the incline, his attention was called to the sample-cuts, which were every five feet alternating on the two sides of the incline and drifts therefrom. In the raises the cuts extended from the incline sunk on the foot-wall the full height of the raise, in several cases 20 to 25 feet. In each cut I had a drill-hole put in and a wooden plug inserted with a tag corresponding to my number on the assay-sheet upon which I had the assay-values plainly marked with the width of each sample-cut.

With a copy of this assay in hand the Captain carefully examined the numbers on the plugs and finally said: "This is excellent work, good sampling, but I will cut some samples to verify the values on the assay-sheet." Spreading the canvas, he personally cut the samples, quartered, sacked, and sealed the sacks, and when a sufficient number had been taken, we returned to Salt Lake and he instructed Officer & Co. to make the tests. While this work was going on, he instructed me to find Mr. Butts, the owner of the mine. I did so, and after the assay-certificates were received, a deal was made for the property, Butts receiving a good substantial payment in cash and a splendid real estate property, worth at least $90,000, located at Boise City, Idaho. I was then ap-

pointed superintendent of the mine and proceeded to open it for production.

I employed Frank Anderson of Salt Lake City to survey the claims and Lee Gilson as assayer. Needing some extra surveying done and Anderson being unable to do it, he sent Robert Gemmell, who did the engineering work for several years. About eight months after the purchase I received a letter from Capt. DeLamar stating that George H. Robinson of Butte City had been appointed general manager of all his Western mining interests; that Robinson would visit Mercur, which he did. After a careful inspection—making no changes in plan or method of development—he questioned me regarding the qualifications of my assayer and stated it would be necessary to have a competent chemist there; that he had one at Butte City and would send him to me. This gentleman, Harry Bacorn, arrived. His work was unsatisfactory to me, and when Robinson arrived one month later, he asked me how I liked the chemist. Plainly, and without knowing he was a relative of Robinson, I told him I preferred to get another man, and stating my reasons, he said: "I hold you responsible for everything going on at this mine. If Bacorn don't suit you, I will find him a place at Tintic." He then asked me if I knew of a good man. I then told him that D. C. Jackling had done considerable work for me at Victor, Colorado, and I believed he would fill the position perfectly; that DeLamar could arrange with MacNeill to have him transferred to Mercur.

Robinson took the address of MacNeill and Jackling and wired DeLamar and in a short time Jackling arrived and took charge of the assaying and chemical department. During this time Colonel Wall came to Mercur and wanted me to interest Capt. DeLamar in the Brickyard mine. I took the matter up with the DeLamar office, then established in the Dooly Block, Salt Lake City, and was instructed to sample the mine. This resulted in its purchase; and shortly after I went with Colonel Wall and made a preliminary sampling of his copper claims in Bingham canyon, now known as the 'Utah Copper.' I spent three days and took my samples to Mercur for treatment. The copper content was very low and the price of copper at that time was about nine cents; consequently no deal was made, but the first knowledge obtained by the DeLamar office was the result of my sampling of the Wall property and nearly two years previous* to the time when the property was offered to our mutual friend, J. W. MacNeill, as stated in your article. When Robinson resigned, H. A. Cohen was appointed manager of the Golden Gate mine. He had previously been serving Capt. DeLamar in some capacity in New York and at the DeLamar mine in Nevada. I, in June, 1897, resigned the superintendency and recommended Duncan MacVichie of Salt Lake to take charge of the property—and I again was placed in the field to obtain another mine—and finally succeeded in bringing about the deal for the Bully Hill copper mine in Shasta county, California, which the Captain purchased, worked, and equipped with smelter, and sold at a profit.

I regard Capt. DeLamar as the best-posted mining capitalist I ever met and he does not belong to that class of mining men who make their money by peddling stock. He believes in getting a property, equipping it with proper machinery, and taking the money from sales of the mining products, proving their merits fully, but he is business-like and always open for an offer on anything he owns. He usually sells to large operating companies and after thorough examination by leading engineers. His experts have covered the entire mining field in quest of desirable properties. I personally examined properties in all the Western States and Territories, Honduras, Mexico, British Columbia, Alaska, and Ontario.

I regret very much that he did not purchase, on my recommendation in 1902, the Hilty claims near the Ollie Oatman spring.

Edward Hilty at that time was the sole resident where the town of Oatman now stands and had locations covering the ground now owned by the United Eastern and Tom Reed mining companies. I had secured the option to purchase for $70,000. I prevailed on one party to take over my option, but lacking sufficient capital to properly develop, the property reverted to the owner. With the Captain's money and management a different story would have been told. I also secured an option on the Gold Road at the same time. This his manager also declined. The production of this mine has probably reached $4,000,000. The Tom Reed and United Eastern have yielded about $7,000,000 to date, and are still producing. These properties should have been under DeLamar control, and would have if he had personally visited the property with me.

GEORGE KISLINGBURY.

Los Angeles, October 21.

*[Mr. Kislingbury is in error; he refers to events in 1895 or 1896; Mr. MacNeill did not become interested in the Utah Copper deal until six years later.—Editor.]

Electrolytic Zinc

The Editor:

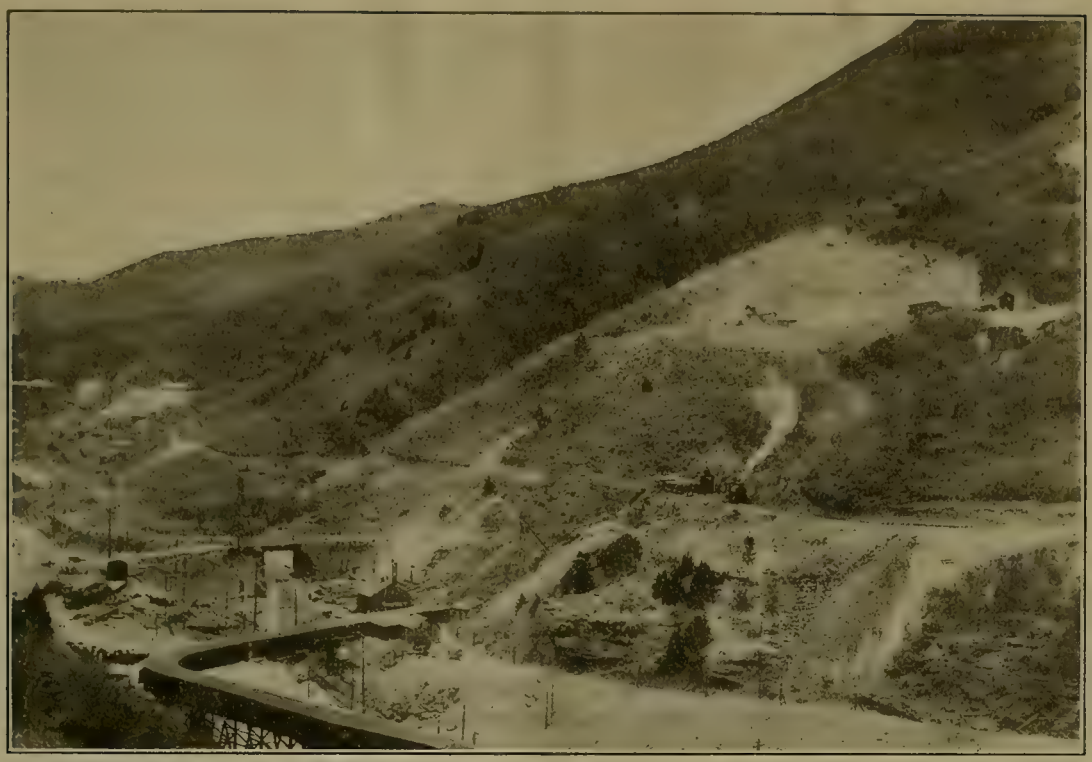
Sir—In your last issue, you credit me with a statement regarding electrolytic zinc. I think that the statement in question was made originally by Mr. French, and that it was quoted by Mr. Yardley during the discussion of my paper on electrolytic zinc at the last meeting of the Institute in Denver. While the statement is not mine, I agree perfectly with the sentiment it expresses.

C. A. HANSEN.

Salt Lake City, October 21.

[This refers to the statement that zinc sulphate only is required for the electrolysis of zinc.—EDITOR.]

MANGANESE acts as a catalyst in the fixation of atmospheric nitrogen by plants through the aid of bacteria. Tests by A. de G. Rocasolano show that the nitrogen-fixing bacteria, grown in pure culture, do not fix nitrogen when manganese is absent. The highest amount of fixed nitrogen is obtained when 0.006% of Mn in available form is present.



THE FIRST STEAM-SHOVEL STARTING TO WORK ON THE WEST SIDE OF BINGHAM CANYON IN AUGUST 1906

The Utah Copper Enterprise—V

Mining Methods

By T. A. RICKARD

The control of Colonel Wall's property passed to Messrs. Penrose, MacNeill, and Jackling, as already related, in the spring of 1903, and the construction of an experimental concentrating plant—the Copperton mill—was begun in August. The extraction of ore underground began in November. These first mining operations by the Utah Copper company had for their primary object the supplying of 300 tons of ore daily to the Copperton mill. Most of this output was obtained from development work and sub-level drifts. At first no particular system was adopted, the ore being simply stoped from the sub-levels in chambers extending up to the 'cap,' which was supported on stulls. When broken the ore was shoveled into cars and trammed to chutes, through which it was delivered to cars on the haulage-levels and trammed to the bins outside. As the capacity of the Copperton mill was increased and an additional tonnage had to be provided, a plan was devised of digging a number of small raises under each pile of broken ore, which was then withdrawn from below and thus moved without shoveling. The sub-levels were driven 25 ft. apart vertically, and later the ore was withdrawn through a system of small raises with numerous branches, which met those of the adjoining raises. The ground between these 'finger' raises was blasted, causing the ore to cave. The caved ore was withdrawn through chutes at the bottom of each raise until the cap-rock began to appear, indicating that all the overlying ore had been tapped. This method has been elaborated at the Inspiration mine, at Miami, Arizona, as described by me in the MINING AND SCIENTIFIC PRESS of September 29, 1917. The method is well defined by George R. Lehman,* who says that it consists "essentially, of undercutting the ore (taking out a horizontal slice), allowing the ore above to cave and crush, and drawing off the crushed ore through small inclined raises, driven under the caved ore, into main inclined raises that lead down to the haulage-drift chutes." The aim, of course, is the

*'Ore-Drawing Tests.' By George R. Lehman. Trans. A. I. M. E., Vol. LV, p. 225.

excavation of ore with the aid of the minimum amount of timbers and explosives, utilizing and controlling the descent of ground that has been induced to cave. The underlying idea is to persuade Nature to do as much of the work of fracturing and moving as is consistent with the safety of the mine and of the men underground.

At the time this method of mining was used at the Utah Copper it was realized that it would entail some admixture of 'cap' with ore, but this was considered to be relatively unimportant, as it was known that the entire orebody was to be stripped subsequently in preparation for digging with steam-shovels, so that the mixing of 'cap' and ore would not cause any serious loss because these two products could be excavated separately by the steam-shovels.

Such was the first mining. All the ore produced up to June 1907 was obtained in this way. Mr. Jackling was general manager; in January 1906 he appointed Mr. Gemmell as general superintendent. He returned from Mexico to accept the appointment, for which he was peculiarly fitted not only by his wide experience in the work of mining but on account of the six years he had spent as engineer in the service of the Santa Fé railroad. In April 1906 he accompanied Mr. Jackling on a visit to the Mesabi range for the purpose of studying methods of mining, more particularly the use of steam-shovels. Among his class-mates at the University of Michigan was William J. Olcott, distinguished among the engineers of the iron country, and to him Mr. Gemmell turned when the time came to select a man to take charge of the steam-shovel work. Mr. Olcott recommended J. D. Shilling, who was engaged in July 1906. Mr. Shilling is now the superintendent of the mine; Mr. Gemmell is general manager for the company, and Mr. Jackling, who is directing the operations of several other mines in Arizona, Montana, Nevada, and New Mexico, is managing director and first vice-president. Mr. Charles M. MacNeill is the president of the company.

The first steam-shovel went to work in August 1906. The chief duty of the steam-shovels was to strip the cap, or overburden, in preparation for the application of an open-cut or terrace system of mining to the ore underneath. At the end of 1909 the ground stripped amounted to 3,232,000 cubic yards. As the cap was removed, it became possible to quarry the ore. The first production by this method was made in March 1907.

Given unlimited money and time, it might have been possible to start the steam-shovels at the top of the mountain and work downward by successive terraces, but mining engineering is allied to business, that is, to the making of money, and it is doubtful whether it would have been economical to do the apparently obvious thing. In the first place, such a method of attack would have necessitated a long delay while the requisite amount of stripping was accomplished and large sums of money would have had to be borrowed, by the sale of securities, in order to finance the operations pending the attainment of profitable production. By starting underground mining, the company was able not only to extract ore forthwith for the Copperton mill but also to extend exploratory work in such a way as to ascertain the limits of the orebody and to develop the ground in preparation for the enormous exploitation that the manager had in view. Moreover, the Utah Copper Company did not own the top of the mountain until, in February 1910, it acquired the property of the Boston Consolidated Mining Co., thereby increasing its area of lode-mining claims to 665.5 acres. The company now owns 830 acres of mining ground. At that time the Arthur mill of the Boston Consolidated also passed into the possession of the Utah Copper, which had previously finished its Magna mill in 1907; so that an enormous tonnage of ore (13,000 tons daily) was demanded. Owing to exigencies of milling capacity it became necessary to continue the shrinkage-caving system on the Boston Consolidated ground, because there was no ore stripped and ready for steam-shoveling in that part of the mountain and steam-shovel operations on the original Utah Copper ground were not sufficiently far advanced to permit of supplying both of the big mills except by aid of underground stoping. Therefore the use of underground mining methods, which had ceased in the original Utah Copper ground on September 17, 1912, was continued in the Boston Consolidated ground until March 31, 1914, by which time the stripping had been so far advanced, and the terraces so well started, as to enable the steam-shovels to supply both mills.

An excellent description of the shrinkage-stoping system as used in the Utah Copper mine is given by T. S. Carnahan in Vol. LIV (1916) of the Transactions of the American Institute of Mining Engineers. The system of mining that was adopted was devised so as not to interfere with the steam-shovel operations, which were foreseen from the start. It was essential, therefore, "that the surface should not be caved, that no large openings be left unfilled, and that the capping should not be mixed with the ore." To accomplish this, the stopes were started from three separate levels or tunnels. The lowest of these served for motor-haulage; the second, 150 ft. higher, was equipped for hand-tramming, as was also the third entry, 100 ft. higher than the second. These levels were connected by manways and by raises for dropping the ore from the upper workings to the motor-haulage level. An underground shaft connected the workings and was used for hoisting supplies, using a compressed-air engine. The connections with the surface were more than sufficient to ensure ventilation. Fig. 1, 2, and 3 are borrowed from Mr. Carnahan's article. He states that it was the custom to divide the orebody in blocks 500 ft. wide and to finish stoping on the top level considerably in advance of the stoping started from the middle level. "In this way the upper stopes were abandoned before the stopes from below began to disturb the tramming-drifts and stope-manways." Likewise the stopes above the middle level were kept well ahead of those started from the main level. During three years, 1911 to 1913 inclusive, 2,824,439 dry tons of ore was drawn from the mine and loaded into railroad-cars at a

cost of 56.6 cents per ton. In addition 102,719 ft. of development yielded 247,280 dry tons at a cost of $4.95 per foot of development, or $2.05 per ton of ore.

Before making systematic preparation for the steam-shovel method of mining, it was deemed advisable to obtain expert advice from the iron regions. In the opinion of the experts the canyon was too narrow and the working-area too limited for the best results from steam-shoveling, but the chief obstacle to this method of removing the ore appeared to be the manner in which the ore-bearing rock would be broken in the course of blasting, namely, in lumps so large that they would have to be reduced mechanically before delivery by the steam-shovel to the cars and bins. Therefore they advised the driving of mill-holes to the surface at intervals of 50 or 75 ft., breaking both the cap and the ore into these raises, for discharging into cars. Mr. Jackling, however, demurred to this opinion and after discussing the matter with Seeley W. Mudd and A. C. Beatty, who were then examining the mine for the Guggenheims, preparatory to their underwriting the bond issue, he went to the Mesabi iron region himself, with Mr. Gemmell, as I have previously stated, in order to get the fullest possible light on the subject. The result of this journey of observation was to confirm Messrs. Jackling and Gemmell in their decision to introduce the use of the steam-shovel as rapidly and completely as circumstances would permit. In the report by Mr. Mudd, dated October 14, 1905, he states: "There seems little reason to doubt the feasibility and desirability of mining with the steam-shovel. This would, of course, necessitate the stripping off and removal of the waste and low-grade surface ore, and this would involve a considerable initial expense, but in the end, this expense would be justified."

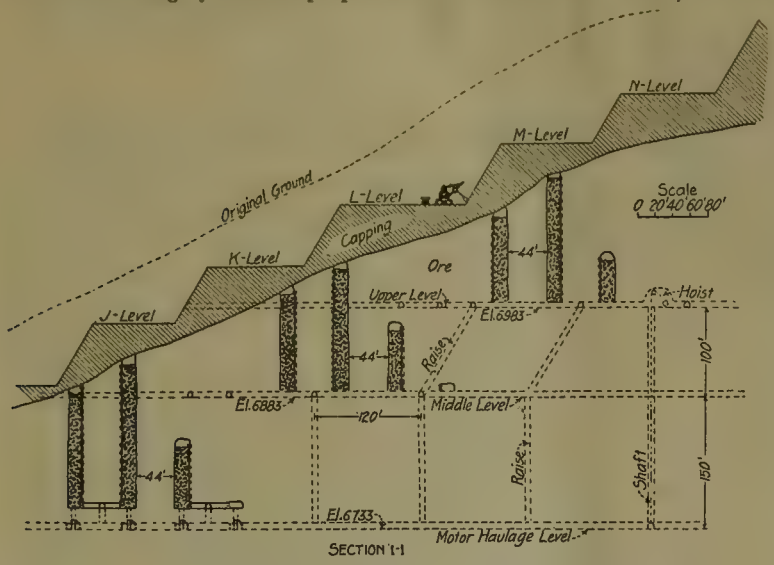


FIG. 1. SECTION SHOWING RELATIVE POSITION OF STOPES TO STEAM-SHOVEL TERRACES

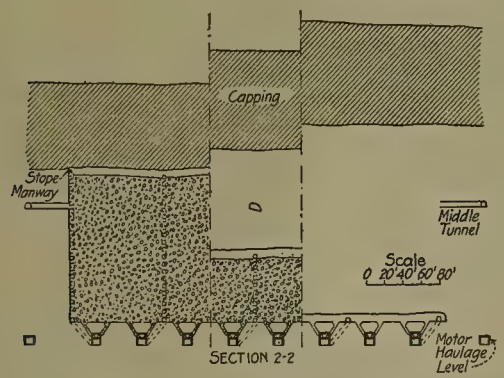


FIG. 2. SECTION SHOWING THE THREE STAGES OF STOPING ABOVE THE HAULAGE-LEVEL

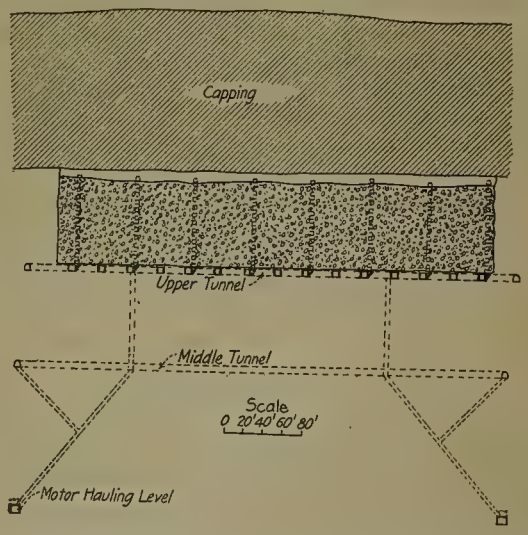


FIG. 3. SECTION SHOWING HOW A STOPE IS STARTED ABOVE THE UPPER LEVEL AND THE RAISES THROUGH WHICH THE ORE IS DROPPED TO THE HAULAGE-LEVEL.

shovel method of mining, it was deemed advisable to obtain expert advice from the iron regions. In the opinion of the experts the canyon was too narrow and the working-area too limited for the best results from steam-shoveling, but the chief obstacle to this method of removing the ore appeared to be the manner in which the ore-bearing rock would be broken in the course of blasting, namely, in lumps so large that they would have to be reduced mechanically before delivery by the steam-shovel to the cars and bins. Therefore they advised the driving of mill-holes to the surface at intervals of 50 or 75 ft., breaking both the cap and the ore into these raises, for discharging into cars. Mr. Jackling, however, demurred to this opinion and after discussing the matter with Seeley W. Mudd and A. C. Beatty, who were then examining the mine for the Guggenheims, preparatory to their underwriting the bond issue, he went to the Mesabi iron region himself, with Mr. Gemmell, as I have previously stated, in order to get the fullest possible light on the subject. The result of this journey of observation was to confirm Messrs. Jackling and Gemmell in their decision to introduce the use of the steam-shovel as rapidly and completely as circumstances would permit. In the report by Mr. Mudd, dated October 14, 1905, he states: "There seems little reason to doubt the feasibility and desirability of mining with the steam-shovel. This would, of course, necessitate the stripping off and removal of the waste and low-grade surface ore, and this would involve a considerable initial expense, but in the end, this expense would be justified."

Mr. Mudd gives 94.43 cents per ton, as the cost of mining by the Utah Copper company during the twelve months ending June 30, 1905, and mentions that "the Utah Construction Co., a large firm of railroad contractors, has made a provisional offer to the Utah Copper Co. of 60c. per yard, or 30c. per ton, the contractors agreeing to furnish all equipment and deliver the material not to exceed 2000 ft. from the point at which it is mined. The San Pedro Railroad construction work was done on a basis of 65c. per yard for rock, and most of the material was hauled in carts. Such a price is not abnormal. In the Michigan iron mines, the cost of mining with steam-shovels has been reduced to 12c. per ton or less. . . . Taking all these circumstances into consideration . . . a cost of less than 40c. per yard is

probable, but for the purposes of this estimate, we will assume a cost of 50c. per yard, an average thickness of stripping of 80 ft., and an average thickness of pay-ore beneath to be mined of only 160 ft. On this basis it will be necessary to mine three tons of material to secure two tons of payable ore. Assuming a yard to equal about two tons, the cost of mining would be 37½c. per ton, including the cost of stripping. I believe this figure will be found safe, notwithstanding several unfavorable features which should be considered, but the cost of 40c. per ton will be used in the estimates."

The "unfavorable features" include those recognized by some of the steam-shovel experts, namely, the railroad, county road, and dwellings in the gulch, also the steepness of the hillside, causing the stripping to slide when under-cut, and the probable need of a tunnel in order to reach the deeper ore.

In Mr. Jackling's original report, of 1899, there is more about the metallurgy than the mining of the ore, because, among other reasons, the writer of that report was primarily a metallurgist, but it is worth while to quote his reference to the method of mining to be adopted. He said: "For working the property, it is proposed to build a concentrating plant of 2000 tons daily capacity, and a smelter and refinery of 125 tons daily capacity, near the point of the mountain between Salt Lake City and Garfield Beach, where water is plentiful and railroad facilities good. This point would be connected with the mine by 15 miles of standard gauge railroad. The ore would be worked by quarrying or open-pit methods, the overlying deposits of wash and low-grade material being first stripped off the ore and hauled by railroad to the most convenient dumping-ground. Both the ore and waste would be loaded on cars by steam-shovels. Drilling at the mine would be done with air-drills, for which air would be supplied by a small electric compressor plant, centrally located on the ground." He estimated three tons of 'wash' and eight tons of ore per square foot of surface; the cost of stripping to be 75c. per cubic yard, or 37½c. per ton, so that the cost per ton of ore would be 14 cents. He estimated the cost of mining the ore at 40c. and of hauling it to the mill at Garfield, 15c., making the total cost of stripping, mining, and delivery to the mill 69c. per ton.

Colonel Wall, writing in 1904, in a pamphlet called 'The Mountain Empire, Utah', anticipated that the cost of mining, using the mill-hole method, would be 15c. per ton and that of milling 20c. per ton of ore. He expected the cost of railroad transport, from mine to mill, to be reduced to 5c. per ton. Taking the average copper content of the ore at 2.2%, with 75c. in gold and silver, he anticipated a recovery of 80% and he expected the cost of smelting to be "less than the value of the gold and silver contents."

In 1917, the charge made for stripping against the ore mined during that year was at the rate of 7.5c. per ton of ore; for development, 1.04c. per ton was allowed; while the actual cost of mining was 18.04c. per ton, to which 0.94c. was added for depreciation, 15.99c. for taxes, 1.91c. for insurance, general office expense, legal expense, and salaries. Thus, including stripping, development, and the other necessary charges, the average cost of mining was 45.42 cents per ton of ore. The freightage from the mine to the mills at Garfield represented a cost of 25c. per ton.

(To be Continued)

Engineering Positions in the Army

The U. S. Civil Service Commission calls attention to the following positions in the Construction Division of the Army:

50	Chiefs of survey party	$2700 to $3000
50	Transitmen	2400
25	Levelmen	2100
150	Chainmen	1800
125	Rodmen	1800
50	Topographic draftsmen	2100

Examinations are for men only, except those for draftsmen, which are open to both men and women. All of the positions are exclusively in the field, except the drafting positions, some of which are in the field and some in the office at Washington. The examinations are of the non-assembled type, and competitors will not be assembled for written examination, but will be rated upon their education, training, experience, and physical ability, as shown by their applications and corroborative evidence. Further information, together with the required application blanks, may be obtained from the Secretary of the Twelfth Civil Service District, Room 241, Postoffice building, San Francisco.

THE greatest practical advance in the commercial production of potash from kelp was made during 1915, when the Hercules Powder Co. started the construction of large gasoline-propelled marine kelp-harvesters and a factory near San Diego, California. This equipment was designed primarily for the production of acetone, potash, and iodine from kelp. Kelp as a source of acetone was something new to chemical industry, and chemists all over the world have watched the development of the undertaking with great interest. The plant, since its inception, has increased the number and range of its products, and placed upon the market new materials which are full of industrial promise. Reduced to its simplest terms, the basic principle of this process of kelp-reduction lies in the destruction of the cellular tissue of the kelp-leaf by fermentation, bringing the potash into solution, and producing acetic acid as the product of the fermentation. The acetic acid is neutralized with limestone, giving calcium acetate, potash, and iodides in the solution.

NICKEL ORE is being developed by the Perseverance Nickel Co., composed of Cuban people, at Sierra Prieta, 19 miles north-west of Santo Domingo, in the West Indies. The ore is low-grade, and will be mined by steam-shovels. A 13-mile railway is to be constructed between the mine and the Ozama river.

Sodium Sulphide in Cyanidation

By F. WARTENWEILER

*For a number of years it was a well-established fact in the treatment of ore at the Prestea mine, in the Gold Coast Colony, West Africa, that the carbonaceous schist prematurely precipitated a portion of the gold dissolved by the cyanide solution. This difficulty engaged the serious attention of metallurgists, and the company displayed commendable progressiveness by devoting considerable funds toward research and large-scale experimentation.

The first positive light on the problem was the discovery in 1914 by W. R. Feldtmann[1] that gold precipitated prematurely by charcoal, or by carbonaceous schist, was soluble in a solution of an alkaline mono-sulphide, preferably, for commercial reasons, sodium sulphide. Experiments on Prestea ore at once established the applicability of the discovery. The author was fortunate in having, in 1915, the responsibility of the first practical application of this solvent[2] and then its development into a working process at a later stage.

The ore is a white quartz, brecciated, and seamed with carbonaceous schist, which also occurs as a wall-rock. The gold occurs free and associated with iron pyrite and arsenical and antimonial sulphides. Crushing and grinding are effected respectively with stamps and pans. Amalgamable gold from the raw ore is recovered by the concentrating action of the pans and by pan amalgamation, also by collecting on blankets, by subsequent barrel amalgamation, and by direct pan amalgamation. Wilfley tables are used to separate mineral sulphides. The concentrate is roasted, ground, and amalgamated in pans, and cyanided. Of the concentrate tailing, classified into sand and slime, the sand is cyanided and then treated with the sodium-sulphide process. The application of the same treatment to the slime will be investigated when plant now under construction is at work.

Fig. 1 explains the general scheme of treatment.

The first application of the process was made in the treatment of sand-residue from the cyanide works, the sulphide solution being aded after practically all the cyanide had been displaced by a water-wash. The extraction was normal (equal to laboratory tests), but the total cyanide plus sulphide treatment lasted over an extended period, necessitating the installation of additional vats.

Leaching the sand from the start with a sodium-sulphide cyanide solution did not compare favorably with laboratory tests on account of the difficulty of preserving an efficacious strength of sodium sulphide concurrently with the secondary reaction due to varying quantities of sodium-zinc cyanide (originating in the zinc extractor-boxes) precipitating white zinc sulphide, and with the greater depth of the sand charge to be leached as compared with a laboratory percolation. This depth (6 ft.) made it impracticable to bring solution of the proper strength in contact with all parts of the charge and at the same time obtain an effluent carrying no free sulphide.

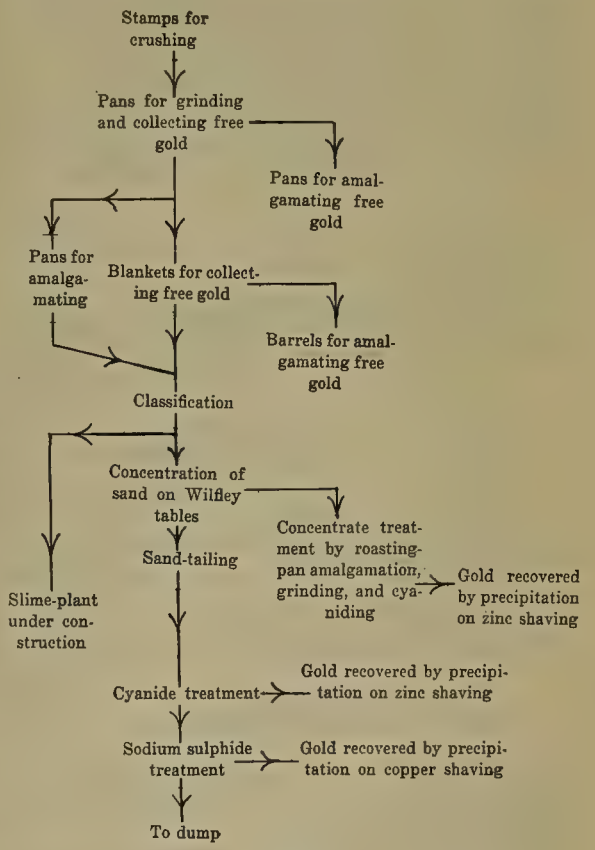

Stamps for crushing
Pans for grinding and collecting free gold
Pans for amalgamating free gold
Pans for amalgamating
Blankets for collecting free gold
Barrels for amalgamating free gold
Classification
Concentration of sand on Wilfley tables
Concentrate treatment by roasting-pan amalgamation, grinding, and cyaniding
Gold recovered by precipitation on zinc shaving
Sand-tailing
Slime-plant under construction
Cyanide treatment
Gold recovered by precipitation on zinc shaving
Sodium sulphide treatment
Gold recovered by precipitation on copper shaving
To dump

FIG. 1

After many experiments the starting-point of the sodium-sulphide solution treatment was finally fixed, and the scheme of operation developed as follows:

(1) A 240-ton charge of sand, after leaching with strong and medium cyanide solution, was at first followed by one-half the usual weak solution and allowed to drain beneath the surface. In the present practice the charge is leached dry before the sulphide is added.

*Abstract of a paper read before the Institution of Mining & Metallurgy, London, on July 25, 1918.

[1]'The Precipitating Action of Carbon in Contact with Auriferous Cyanide Solution,' W. R. Feldtmann. Trans., Vol. XXIV.

[2]Discussion on Feldtmann's paper. Trans., Vol. XXIV, p. 360.

(2) 60 to 70 tons of sodium-sulphide solution is then added and leached continuously.

(3) This treatment is followed by the addition of 100 tons of water-wash; the vat is drained dry and discharged.

(4) The Na_2S stock solution is made up to 0.2% strength by titration with $ZnCl_2$ solution.

The method adds only eight hours to the former cyanide treatment schedule, the sulphide solution taking the place of the second 80 tons of weak cyanide wash. There is no clean definition in the leaching-vat between the cyanide solution and the displacing solution of sodium sulphide; a zone of a mixture of the two gravitates through the sand and is effluent, carrying with it the white precipitate of ZnS. This mixed zone assays as high as 3 dwt. gold per ton, also free cyanide, part of which has been regenerated by the precipitation of the zinc from the sodium-zinc cyanide.

Fig. 2 explains the operation diagrammatically. The detail treatment is illustrated by the following typical log of a sand charge, some two months after the process had been in use on the entire currents and tonnage:

	Assay per ton, shillings
Sand charge, 240 tons	12.0
Residue after Na_2S treatment	3.7
The cyanide residue would be approximately	6.0

After 80 tons of weak cyanide-solution wash had leached beneath the sand-surface, 70 tons of Na_2S solution was added, followed by a water-wash of 100 tons.

			NaCN	Na_2S	Gold per ton	
		October 16		%	s.	d.
(a)		11:00 a.m. Na_2S. On going	0.01	0.29	1	0
(b)	To CN zinc-boxes	12:00 a.m. Effluent solution	0.064	Nil	1	4
(c)		2:30 p.m. Effluent cloudy, with ZnS to by-pass	0.07	Nil	2	0
(d)	To by-pass	4:00 p.m. Effluent	0.092	Nil	4	8
		5:30 p.m. Wash-water added				
(e)	To clarifier	5:45 p.m. Effluent to clarifier	0.058	0.07	10	0
(f)		8:15 p.m. Effluent to strong Cu boxes	0.032	0.17	11	0
		October 17				
		12:00 p.m. Effluent	0.01	0.22	6	2
(g)	To strong sol. Cu boxes	4:00 a.m. Effluent	0.008	0.112	2	6
		8:30 a.m. Effluent to waste-sol. Cu boxes		0.028	2	4
		6:00 a.m. Wash-water all on				
	To waste-sol. Cy boxes	12:00 a.m. Effluent		0.01	0	6
		3:00 p.m. Effluent (last draining)		0.008	0	7

(*a*) The Na_2S strength of stock solution was high in this case (0.29%); it has been reduced to 0.20%, with no difference in extraction.

(*b*) Indicates the strength and assay of the effluent cyanide solution just ahead of the mixed CN·Na_2S zone.

It is noted that the gold value is on the decline. (The maximum gold content of the effluent solution during cyanide treatment is 2s. 6d. per ton.)

(*c*) The beginning of the mixed zone showing ZnS. The Na_2S has been entirely decomposed.

The assay shows the first contact of the gold dissolved by Na_2S.

(*d*) The solution over this period being high in cyanide and containing from nil to a low percentage of Na_2S, but with precipitated ZnS in suspension, is by-passed the precipitating-boxes to the barren strong or medium cyanide-solution sump, raising this sump-solution to approximately 1s. in gold. Any free Na_2S combines with the $Na_2Zn\ CN_4$ of the cyanide-treatment solution, regenerating NaCN with the precipitation of ZnS. Although this effluent contains a certain amount of gold of Na_2S solvent origin, it is precipitated on the zinc shaving with the gold from the gold-cyanide solution, when it reaches the precipitating-boxes.

(*e*) The effluent is still from the mixed zone, high in gold, increasing in Na_2S content, and diminishing in NaCN. It is by-passed to a clarifier (3 ft. depth of sand), where the ZnS is readily left behind; then through the copper-shaving precipitating-boxes, depositing its gold on the CuS; thence it flows to the Na_2S sump or to waste according to its sulphide content.

(*f*) The effluent is now clear and is run direct to the precipitating-boxes; thence to the precipitated Na_2S solution sump to be made up to stock strength.

(*g*) The low Na_2S strength effluent is turned for the remainder of the treatment to the waste-solution precipitating-boxes set apart for this purpose; the box-tailing is run to waste.

Samples of Na_2S residue are frequently re-treated in the laboratory with fresh 0.3% Na_2S solution, as extraction tests. The results of two average tests are:

	Shillings		Shillings
Residue	3.8	Re-treated residue	3.8
Residue	4.0	Re-treated residue	4.0

Before finally arriving at the treatment described, various modifications were on trial and discarded by reason of greater complication with no compensating improvement in extraction. Among these may be mentioned:

1. Saturation of the drained sand-charge with stock Na_2S solution from below the filter.

2. Circulation of the Na_2S solution through the charge by returning the effluent solution over the top of the vat with an air-lift.

3. Starting the Na_2S treatment at all stages of the cyanide treatment.

Referring to the ZnS precipitate settling in the medium cyanide stock-tank, also used as the Na_2S mixed-zone solution by-pass; this precipitate carries but little gold, assaying only 4.3s. after six weeks.

It was ascertained by experiment in the laboratory that the by-passed gold in this sump, from the Na_2S solvent source, is not precipitated in its subsequent leaching passage through the sand charge. The gold brought into solution by the Na_2S is immune from precipitation by carbonaceous schist. This is substantiated by the fact that no gold is precipitated from the Na_2S solution in passing through the clarifying medium composed of sand; assays of solution and assays of clarifier-sand are confirmatory.

The ZnS of the mixed-zone effluent, for all intents and purposes, does not carry gold nor does it act as a precipitant.

The hydrate of lime of the cyanide solutions apparently reacts with the Na_2S and sulphites of the commercial substance used, resulting probably in the formation of calcium hydro-sulphides and calcium sulphides. No

free lime or caustic soda is present in the effluent Na_2S solutions. The decomposition of Na_2S by calcium hydrate appears to be approximately at the rate of:

1 lb. CaO decomposes 0.33 lb. Na_2S.

An incomplete analysis[3] of a working Na_2S effluent solution after one month's operation is here given:

Gold	2s.2d.	Cu	Nil
Na_2S	0.125%	Fe	Trace
KCN	Trace	CaO	Nil
Hg	Nil	*Zn	0.13%

*In suspension as ZnS.

Precipitation of the gold is effected by passing the effluent Na_2S through boxes filled with copper shaving. The boxes are of a design identical with the zinc-shaving extractor-boxes used in the cyanide process. Fresh copper shaving when immersed in the Na_2S solution immediately has its surface coated with a film of CuS, which was first considered to act as a precipitant for the gold. Later experience showed this not strictly correct. Fresh CuS, which had been removed from the surface of the box, proved a poor precipitant of gold from Na_2S solutions, but similar CuS if allowed to remain exposed to the air for a week becomes much more active. Experiments with a small laboratory copper precipitating-box show that the surface of freshly annealed copper is extremely active, and precipitation is good, but that as the deposit of CuS increases in depth, so does the precipitating power of the metal decrease. In this particular case, the normal box-tailing was about 9d. per ton. After one week, the tailing rose to 2s. per ton. The shavings were washed free from adhering CuS and replaced in the box, when the tailing dropped to the original figure. Close contact with the metal is essential.

Very little copper goes into solution; the principal secondary reaction in the boxes is the formation of the copper sulphide. Fresh shavings are added periodically as required, similar to the practice with zinc-boxes. When once well packed with annealed copper-shaving, the boxes are effective without replenishment for a week. Previous clarifying the cloudy mixed solution, the ZnS settled in the copper-boxes and fouled the head compartments. The clean-up of this ZnS-CuS gold precipitate was extremely messy, and zinc persistently hung on throughout the refining, even liquating out of the final copper-gold bar. Clarifying of the solution remedied this trouble.

The average assay of the box-tailing over one month was 3.4d. per ton from an average head assay of 3s. per ton.

As noticed in other Na_2S determinations, there appears to be a decomposition when strong solution is passing through the boxes, and a slight re-generation with solutions weak in sulphide. It is, of course, essential that precipitation be complete in the weak-solution boxes, as the tailing is at present sent to waste.

The copper-boxes in use are:

3 for strong solution of 314 cu. ft.

2 for weak solution of 220 cu. ft.

The average solution precipitated per ton of sand is 0.55 ton, say, 130 tons for a 240-ton charge. The average Na_2S solution passing through the 5 boxes is approximately 330 tons daily on 600 tons of sand, giving

1.6 cu. ft. of shaving for one ton of solution per diem, or

0.62 ton of solution per diem per 1 cu. ft. shaving.

This capacity is considerably less than the zinc-shaving capacity for precipitating auro-cyanide solutions,

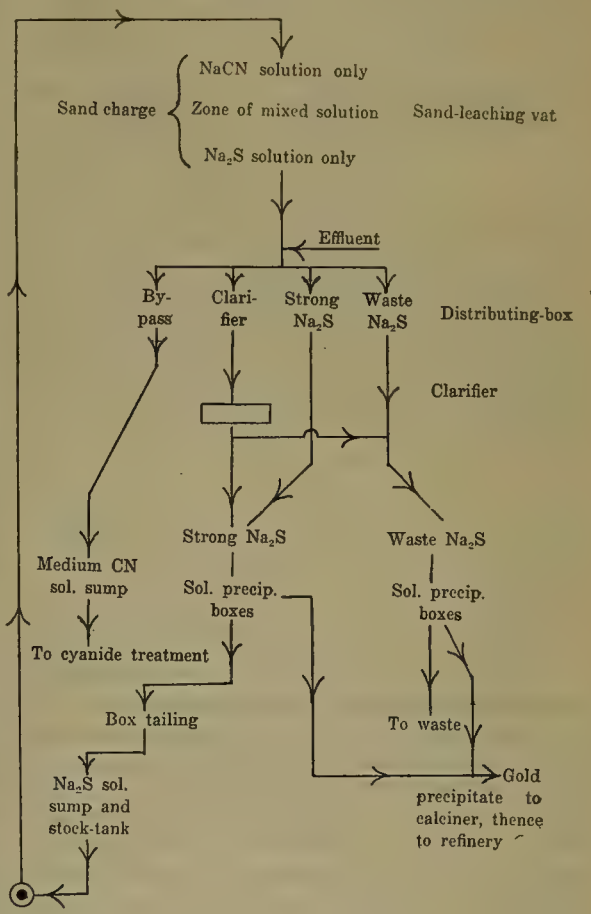


FIG. 2

which at Prestea averages one ton of solution per diem per cubic foot of shaving.

It follows that the Na_2S solution flow must be slower through the precipitating-boxes than is the practice with cyanide solution. This may be due partly to the greater gold content of the sulphide solution.

The copper content of the copper-box tailing is low; analysis of a working solution gave:

	Cu
Strong-solution box-tailing	0.002%
Waste-solution box-tailing	Trace

The clean-up and refining are done as follows:

(*a*) Washing of all shavings in the precipitating-boxes; pumping all the fine to a settling-tank, adding lime. The coarser precipitate, with short copper, from below the screen is handled by buckets direct to the drier.

(*b*) Filter-pressing the fine, after decanting clear water. This is a tedious operation, as the sulphides choke

[3]By A. E. Bidlake, chemist and assayer at Prestea.

the filter-cloths. The mixing of part of the insoluble smelting-flux (charcoal and fine sand) with the thick sludge is found to aid the filtering.

(*c*) Drying of the coarse and fine separately; then screening the coarse through a 14-mesh screen, returning all + 14 mesh (all short copper) to the boxes. Mixing all the dried and screened precipitate.

(*d*) Calcining carefully, with occasional rabbling, in a muffle-furnace until most of the CuS is converted to CuO.

(*e*) Smelting in Morgan fuel-oil tilting crucible-furnaces with a strongly acid flux. The smelting products are:

	Assay		Containing % of total Na_2S gold recovery
	Gold	Copper	
Copper-gold bar	10%	70%	94
Matte	33 oz. per ton	66%	6
Slag	12 oz. per ton	2%	

At first, the calcined precipitate (*d*) was treated with hot sulphuric acid, but with indifferent results, owing to the absence of an oxidizer to dissolve the considerable metallic copper present. The sulphate solutions were passed through precipitating-boxes filled with iron. The acid treatment was soon discontinued.

The flux used in smelting (*e*) the calcined precipitate is:

Roasted precipitate	100
Borax	100
Sodium carbonate	20
Silica	50
Assay-slag	50
Charcoal	8

Assay of a typical calcined precipitate is:

	%
Gold	2.37
Copper	32.70

We melted at a low temperature until the violent action had pretty well ceased, then at high heat for about 15 minutes. The crucible charges were poured into the usual conical molds, the buttons hammered off, and the matte separated from the copper-gold alloy in which the gold is concentrated. A final re-melt was made of all the matte and of the copper-gold buttons in a small furnace. Fortunately the matte and slag carry but a small proportion of gold. Both these are ground up for shipment to a smelter. It is generally a good plan to run small-scale preliminaries in the assay-furnace, to determine fluxing. The large melt is easier than in the assay-furnace on account of mass action and greater heat. A reverberatory-hearth furnace has been considered to replace the comparatively small crucibles. For commercial reasons it was found to be of greater advantage to sell the calcined precipitate direct to a smelter, receiving payment for both gold and copper content. The melting at the mine was therefore discontinued.

An analysis (by Mr. Bidlake) of a copper-gold bar is shown:

	%		%
Gold	10.45	Iron	Trace
Silver	0.39	Aluminum	Trace
Copper	71.50	Insoluble	4.00
Zinc	2.70	Not determined	10.96
Lead	Trace		
			100.00

The insoluble matter was a mixture of sulphur and carbon.

The presence of arsenic was suspected, but failed to be confirmed.

Metallic copper in the form of a sponge, while precipitating the gold from the Na_2S solutions, decomposes the solution, forming a slimy mass of sulphides unfit for filtration. Copper oxide acts in a similar manner.

The copper shavings are turned in a lathe from an annealed cylindrical ingot of copper which has been bored to admit the mandrel. The thickness is approximately 1/500 in., and the maximum width $\frac{1}{4}$ in.; observed against the light, the broad side of a shaving has the appearance of a fine web. In the cutting the shaving becomes brittle, and it is important that it be well annealed before use. This is done by heating to red heat in a muffle, withdrawing and immersing in water. A scale of copper oxide is formed during the annealing; most of this is loosened and falls off in the water-cooling bath, and can be recovered by reduction to metallic copper in the smelting-furnace.

The copper oxide so formed is about 1.3% of the total weight of copper shaving annealed. Shavings have been turned successfully with a standard lathe by native labor.

The sulphide solutions are assayed for gold by the usual methods, namely, the lead-zinc sponge method in the presence of HCl followed by crucible fusion, or the $CuSO_4$ method commonly used on the Rand.

The available Na_2S is determined by titration with a standard $ZnCl_2$ solution. The method is based on the conversion of the zinc chloride to zinc sulphide. Nitroprusside of sodium is used as an outside indicator. For convenience to the shiftman the $ZnCl_2$ solution strength is correlative to the silver-nitrate solution used in the cyanide titration. The method is well adapted for works use, the end point being definite.

The iodine method with starch indicator has been on trial with the view to using as an inside indicator. It was, however, unreliable on working solutions, although fairly accurate on solutions freshly made.

The extra extraction on a sand charge by sodium-sulphide treatment depends on the comminution of the sand, the gold-value, and the amount of graphitic schist. On average, the new process accounts for an additional extraction at Prestea of 2s. per ton of sand treated.

The consumption of the Na_2S is, over a period of several months, 1.2 lb. per ton of sand treated. The actual copper lost (after crediting copper recovered in the clean-up) is not over 0.13 lb. per ton of sand treated. The available Na_2S in commercial sodium sulphide varies between 64 and 55%.

The gold produced by the process over a period of 24 months was £39,448, from 394,864 tons treated at 2s. per ton.

In connection with precipitation, the copper-shaving method was thought from the start to leave room for improvement; the desideratum being a method permitting a simpler clean-up and the recovery of the gold in bar form, comparable in fineness with cyanide gold. With this in view, extensive laboratory and small tests were made by Mr. Bidlake, with electrolytic precipitation. Results were promising when a simple method was discovered of precipitating the gold in the desired form on aluminum shaving or on an alloy of aluminum and zinc. This method awaits favorable market conditions for its

large-scale application in substitution of copper shaving, which meanwhile is playing a useful pioneer part.

PRECIPITATION ON ALUMINUM. The result of these tests may be summarized:

Pure aluminum is highly efficient but is too easily soluble in strong Na_2S solutions, giving rise to violent action in the box, and a waste of metal. An alloy consisting of 50% Al with 50% Zn is better, it stands up well under the solution, and produces a rich precipitate in the head compartments. The deposition of gold on the shaving provided some interesting features.

The alloy was almost entirely replaced by metallic gold alloyed with copper. A portion was treated with 15% H_2SO_4 to dissolve the remaining base, and yielded skeletons of reddish-yellow metal in shape closely conforming to that of the original shaving. This was melted with borax and the bullion assayed.

	%		%
Gold	75.5	Iron	Trace
Copper	21.0	Undetermined	2.0
Zinc	1.5		
Aluminum	Trace		100.0

The final working-test was made with a small 7-compartment box fed with ordinary main-plant working solutions. Our supply of aluminum being limited, and it was possible to fill four compartments only. The alloy consisted of 25% Al and 75% Zn. With this, excellent results were obtained over a continuous run of 41 days. About 450 tons of mixed Na_2S solutions passed through the box in this time.

Average assay-value:

Heading ..... 5.5s. Tailing ..... 0.5s.

During this period the box was not dressed or the shaving handled in any way, yet the precipitation was good right up to the end. At that time a great deal of trouble was experienced with ZnS, and the solutions were never quite free from suspended matter. Naturally the clean-up was a messy affair, but eventually gold was obtained 805 fine.

The precipitating power of this alloy appears to be more than double that of copper; 450 tons of solution through 4 cubic feet in 41 days is a good performance.

The author is deeply indebted to P. R. Nethersole and A. E. Bidlake for the additional information afforded by them in the light of their later experience, which has been embodied in the paper.

GRAVIMETRIC determination of potassium by sodium cobaltinitrite is outlined by C. V. Garola and V. Braun in the 'Journal of the Society of Chemical Industries,' as follows: The solution of the potassium salt, containing about 0.25 gm. KCl, and free from other bases except Na, is evaporated to 25 cc. and treated with 25 cc. of sodium cobaltinitrite solution consisting of $Co(NO_3)_26H_2O_3$, 28.6 gm., glacial acetic acid 50 cc., $NaNO_2$ 180 gm., and H_2O to make 1000 cc. After 18 hours the precipitate is collected, washed with 10% AcOH, then once with 95% EtOH, dried at 100°, and weighed. The weight is multiplied by 0.2074 to obtain the quantity of K_2O present. The method is accurate.

Roasting Sulpho-Telluride Gold Ore

In a paper on 'Roasting for Amalgamation and Cyaniding Cripple Creek Sulpho-telluride Gold Ores,' presented by A. L. Blomfield and J. M. Trott at the Colorado meeting of the A. I. M. E., the practice followed in the Golden Cycle mill at Colorado Springs was outlined. The Edwards duplex roasting furnaces are used, and the capacity of each furnace ranges from 80 to 150 tons per diem of 24 hours, the higher capacity being obtained with ore containing more than 2% lime (CaO). The sulphur content of the ores is approximately 1.8%. The crushing previous to roasting is done in ball-mills giving a product of which 46% lies between $\frac{1}{8}$ in. and 20 mesh, 57% of the discharge being coarser than 20 mesh. Coarse material does not roast sufficiently well, leaving soluble sulphides, which increase the consumption of cyanide. The roasting temperatures range from 800° to 900°C., the higher heat being desirable with high lime content. The chemical reactions are given as follows:

SILICIOUS ORES. $FeS_2 + \text{heat} = FeS + S$.

$FeS + \text{heat} + O = FeO + SO_2$.

FeO may further oxidize to Fe_2O_3.

$FeSO_4$ is found when roasting at low temperatures, but at high temperatures this decomposes into FeO and SO_3 or $SO_2 + O$.

BASIC ORES. In the roasting of calcareous ores containing metallic sulphides, if sufficient sulphur be present the lime is converted almost quantitatively into $CaSO_4$. The behavior of $CaSO_4$, when heated in the presence of CO and C, has been investigated by H. O. Hofman and W. Mostowitsch.* The chemical reactions and temperatures stated herein are quite largely taken from their reports. They are given, as they appear to fit the class of high-lime ores as roasted. The reduction of $CaSO_4$ by CO is indicated in the equation $CaSO_4 + 4CO = CaS + 4CO_2$. The reaction takes place without any loss of sulphur. Very little reaction takes place unless the temperature is above 680°C. Between 750° and 850°C. the action is quite rapid and is completed at 900°C. The reduction of $CaSO_4$ by carbon is indicated in the equations $CaSO_4 + 4C = CaS + 4CO$, and $CaSO_4 + 2C = CaS + 2CO_2$. The action begins fairly well at 700°C. and finishes at 1000°C., proceeding most rapidly between 800° and 900°C. At about 800°C., $CaSO_4 + 2C = CaS + 2CO_2$; above 800°C., $CaSO_4 + 4C = CaS + 4CO$. It was found that CO acted more readily and effectively than carbon alone, both beginning and finishing at lower temperatures. It is probable that the gases CH_4, C_2H_6, and H would act similarly in the reduction of $CaSO_4$, since they are effective with Na_2SO_4.

CaS, if roasted in pure dry air, does not all revert to $CaSO_4$, but forms a product of about 76% $CaSO_4$ and 24% CaO, with a loss of approximately 32% S. This

*Trans. A. I. M. E. (1910), Vol. 41, page 763.

loss of S is accounted for by the interaction of $CaSO_4$ and CaS, according to the reaction $3CaSO_4 + CaS = 4CaO + 4SO_2$.

The complete elimination of sulphur at this point is probably prevented by the failure of intimate contact between the CaS and $CaSO_4$ and the formation of CaO between the $CaSO_4$ and CaS. Action between $CaSO_4$ and CaS takes place in a neutral or oxidizing atmosphere, but not in a reducing one. When heating pure $CaSO_4$ in the presence of oxygen it loses its combined water at 900°C. and begins to decompose at 1250° to 1300°C. In the presence of SiO_2 it starts to decompose and gives off SO_2 at 1000°C. and decomposition is completed at 1250° to 1300°C. The action is shown in the equation $CaSO_4 + SiO_2 = CaSiO_3 + SO_2 + O$.

Roasting for Cyanide Treatment. In roasting for cyanide treatment, both sulphates and soluble sulphides are deleterious. Soluble sulphides are active cyanicides and attack zinc freely. They are active reducing agents and under certain conditions can completely eliminate all oxygen from the solutions. Though precipitating gold to an appreciable extent only in acid solution, when the solution percolating a leaching-charge becomes deoxidized by an excess of soluble sulphide; either gold is precipitated or the undissolved gold is so coated as to render further dissolution so extremely slow that to obtain a commercially good residue is impossible. In agitating slime, especially without air, a similar condition is brought about. It is interesting to note that if such a residue is completely dried or thoroughly treated with a solution of permanganate of potash or other effective soluble oxidizer, then subjected to cyanide treatment, the normal residue is obtained rapidly. Acid sulphates act as virulent cyanicides if not quickly neutralized. Calcium sulphate, formed either in the roasters or by the reaction of soluble sulphates in the ore on meeting the lime in solution, is decidedly deleterious. The hot ore warms the crushing solution. This becomes saturated with calcium sulphate and precipitates as the solution cools. These crystals fill pipes, launders, and Dorr thickeners, render filter-mats and clarifying-mats impermeable, coat Merrill filters, frames and cloths, and form a deposit on the zinc and zinc-boxes. We believe that the chief formation of soluble calcium sulphate, with high-lime ores, occurs in the roasters. It will be noted in the roaster equations quoted that, somewhere above 870°C., the final molecule of water is driven out of the calcium sulphate; it then becomes practically insoluble in working-solutions and does not form a cement in the sand-tanks. For illustration, a ton of deposited calcium-sulphate crystals and slime, if fed slowly or rapidly into the chilean mills, forms a band of cement sand in the leaching-vats and re-deposits throughout the plant. If, however, 10 tons of this material is fed into the comminuters and thence through the roasters, meeting a heat of 870° C. or higher, it cannot be noticed in the cyanide plant. It is commercially possible to roast ores so that they may be treated with the ease of a free-cyaniding raw ore; this is what we call an 'over-roast.' Such ore can be extracted to a finished residue in a good standard cyanide plant. Chemical consumption is held at a minimum. Standard classification is sufficient and no change of solution is necessary. Solution is rapid and reaches a definite end-point, but the roast is decidedly more expensive, and the final residue much richer than that now obtained. The slime-residues show even greater difference in gold content due to over-roasting. Having found that a better residue could be obtained by a cheaper and less complete roast, it was decided to attempt a more efficient treatment by more delicate roasting. This required a quick method of chemical testing and the use of pyrometers to help regulate the temperature of each roaster continuously.

A Permanent File for Mining Records

The exigencies of the War have brought out the necessity of having in Washington a permanent file containing detailed information relating to mines and mining companies, information that is not now available in any library but is needed by the Government in solving many problems relating to the betterment of the mineral industries. The U. S. Bureau of Mines, therefore, has undertaken the establishment of a file in which it intends to place not only data published in the annual reports of directors or mine-managers to stockholders, but also reports of consulting engineers and the information supplied by mining companies in reply to questionnaires submitted to them. The reports of consulting engineers and any mining reports that the author or the operator wishes to have considered confidential will be so regarded; those that may be published later will bear a stipulated release-date such as the author or operator may indicate. In order that this information may be collected as rapidly as possible the Bureau of Mines invites mine operators, consulting engineers, and others to forward copies of reports that they may make on any mining property, these reports to be filed permanently with the bureau at Washington. Also the bureau asks all mining companies that issue an annual report to kindly favor the bureau with a copy for its files.

A firebrick cement, for which saving in time of laying the bricks and long life of the joints are claimed, has been placed on the market under the trade name of 'amalgam.' The bricks are merely dipped in the cement. This does away with the usual buttering or covering of the bricks before they are laid. When used as a lining it is claimed that the covering of the lining bricks with the cement results in an increased life of the brick.

Nitric-acid plants in operation, and those nearing completion in this country, will possess a total capacity of 650,000 tons made from sodium nitrate and 225,000 tons from the oxidation of ammonia.

Technical students at German schools during the summer of 1918 totaled 4393, against 13,000 to 14,000 in normal times.

Mining in Russia

By HERBERT C. WOOLMER

Before the revolution in Russia, mining operations had been carried out on lines somewhat different from those in other countries, the reason for which it is not difficult to understand when it is realized that, in such a vast and undeveloped country, mining centres often arise in places entirely devoid of population.

TRAVELING IN SIBERIA

In order to obtain the labor necessary, these mining enterprises have been compelled (in addition to opening up the mines and equipping them with all necessary plant, machinery, and equipment) to construct complete villages for their employees. In addition to money spent on this, large sums have often to be spent in improving ways of communication to the nearest rail-head.

The erection of a village, or in many cases, of villages, calls for the further erection of churches, hospitals, schools, police barracks, stables, farms, flour-mills, shops, and stores for food, clothing, and other supplies, which, in their turn necessitate a further erection of buildings for the housing of the doctors, nurses, police, storeman, and millers. During the last few years the Russian laws have been considerably altered and amplified in connection with the administration of large industrial and mining concerns, and for each property a district Government inspector investigates, in detail, all the conditions of the peoples' livelihood. These Government inspectors had under their jurisdiction the fixing of wages for the work-people, their housing, education, medical treatment, accidents, etc., and during the last few years the laws were being enforced with much greater exaction; in fact, the workmen were living under conditions far above those in large towns or in the villages from which most of the labor came. Mining companies in general fully understood that in order to obtain satisfactory work from their employees it was necessary to make the general conditions of living as satisfactory as possible.

The pricing of goods in the shops run by the companies had to receive the inspector's sanction, but this was apt to cause a certain amount of discontent, although the companies were usually quite satisfied to make the expenditure, relying upon their profit from the output of the mines themselves. In English-speaking countries the law does not permit companies to carry on trade relationship with their men, but in Russia it is obligatory, and in the past this has been a wise arrangement, in that the companies run their trading establishments on economical and business lines, thus preventing outside traders from exploiting the work-people by selling to them goods at exorbitant prices.

When the revolution took place, one of the first things that the Workmens' and Soldiers' delegates instructed their representatives to demand, was the right to control all these various undertakings, and the experience of one English company, controlling large anthracite mines, in the Donetz district of South Russia, may be of interest:

IRON MINES NEAR KYSHTIM

In June 1917 the employees of this company applied to the local management to form their shops into a co-operative association, to be controlled by a committee

elected by the workmen on the property. They protested against the company making any profit out of the workmen under this heading, and, in fact, against their controlling establishments of this description at all. To start with, arrangements were proposed, and agreed to, between the company and the men, whereby the latter subscribed a certain amount of capital to cover the cost of a portion of the stocks and material, and the balance was taken over by the committee, with a promise to pay to the company on the valuation as and when funds became available. In like manner, committees elected by workmen sprang up on every hand. A committee was formed to supervise the running of the hospital, another to supervise the up-keep and repairs of dwellings, a third for transport arrangements, and also again for the control of the schools, sanitation, and the like, the payments for which was still to come from the company's pocket. Soon after these various concerns had been taken over, a demand was made that the workmen should appoint delegates to discuss with the manager the working of the mine, and soon after they demanded a right to investigate the accounts and books of the company, so that they might know what profits were being made, which would be a just reason (in their eyes) to press for a higher rate of wages all round, which, by the way, was being raised little by little almost every week.

Naturally, as the weeks went by, these conditions got more and more difficult. Many of the demands made by the miners and workmen were such that, if accepted, they would ruin the enterprise, and it greatly depended upon how the manager handled the various questions as to what might be the after-effect. To quote an instance of how careful one had to be: On one neighboring property the manager was beaten to death, and on another he was wheeled to the station some miles away in a wheelbarrow deliberately smeared with thick oil and manure.

On our mine, in order to check and control the demands made by the work-people, and in view of the Russian love for committees of all kinds, a new committee was formed by myself, which was called the Directors Committee, on which were nominated various members who were reliable men, and at the same time were on some of the various committees already appointed by the work-people. This committee was formed to assist the administration, which would refer to it, when necessary, any question that the local committee brought forward, the aim being to come into close contact with them and thus prevent outrageous demands being forwarded direct from them to the manager. This arrangement worked satisfactorily, as the members constituting the Directors Committee, acted as a check on the local and sub-committees, as they did not wish impossible demands to be made by them, which would have to be again discussed by the Directors Committee, of which they were also members.

In addition to myself, two other English members, namely, the mine-superintendent and the chief book-keeper, were on the Directors Committee, and in this way a satisfactory relationship was maintained until December 1917, at which period the work-people were further stirred up through outside influence, and many of the old committee-men were replaced by others having still stronger Bolshevik tendencies. Early in 1918 the chief book-keeper was arrested for several days, and finally he and the manager had to leave the property and seek safety at Kharkoff.

During all this time a small output of coal was being maintained and sold to railways or large works direct. The price had been going up month by month, until in December 1917 it reached the high figure of 60 to 70 shillings (or $17) per ton at the colliery. A little work was still carried out by the miners, who were receiving instead of the normal R1.50 per shift, R10, or more, and were still dissatisfied. All stocks and stores were difficult to procure, while communication by railway was almost entirely suspended. Fighting between Bolsheviks and Cossacks had been going on intermittently during February and March, until gradually a German penetration took place and a German commandant was appointed to control the district. Conditions then began to improve somewhat, and the manager and book-keeper were able to return to the mine in March 1918, the property having been managed in the meantime by the Russian under-ground-manager.

The district was in the hands of the Bolsheviks from January to April, after which time it was controlled by the Germans through the above mentioned German commandant and a few hundred German soldiers. Most of the mines, especially the anthracite ones, ceased work, and the shafts have been inundated with water. Austrian prisoners, who were working in our mine, left on the arrival of the Germans, while the younger of the Russian workmen enlisted in the Bolshevik army, leaving only old workmen, most of them family-men, to stay with the company. Though the district was practically run by the Germans, they did not, at first, interfere with business or internal affairs. Most of the mines in the coal district suffered heavily, not only in the destruction of plant, machinery, etc., and loss of workmen, but more especially by allowing the water to rise in the workings.

At the end of June, however, the German commandant of the district invited the three British members of the staff resident on the property to call and see him, saying he did not intend to interfere with their work, and that they could return with the messenger in his car to make his acquaintance. This invitation they could hardly refuse to accept, and set out to call on him, but on arrival at his office they were immediately imprisoned in very dirty quarters, and the Commandant did not even give them the opportunity of discussing matters with him. Next day they were entrained and sent under guard out of the Don country, straight through to Germany, where they are now lodged (according to information received through Copenhagen at the end of August last) at the civilian camp at Rhuleben.

This affords another instance of the Hun's duplicity and deceit, first by inducing these three Englishmen to go and see him under a false pretense of security, and contrary to international law.

Silver Mining Prospects in Ontario

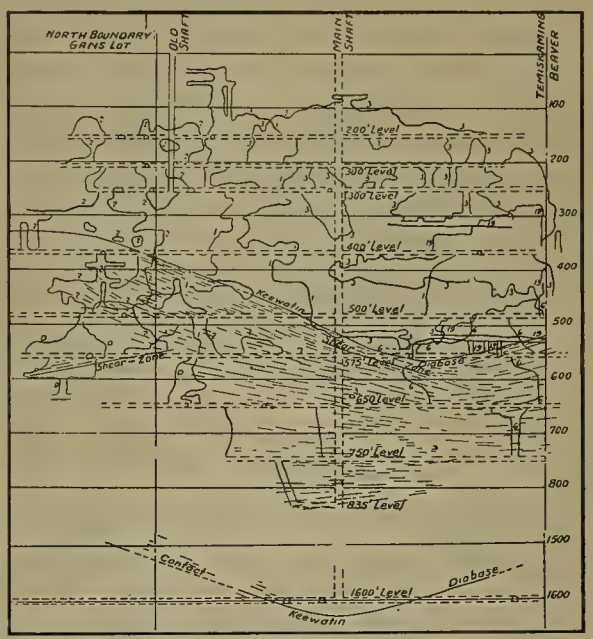
By KIRBY THOMAS

The discovery and development of new silver deposits in Ontario, particularly in the Cobalt district and in the geologically related areas, has not for several years kept pace with the decadence and exhaustion of the productive mines. The disclosure of new veins or of extensions of the ore-shoots in the known veins in the older properties, as at the Kerr Lake and Temiskaming mines, or the Seneca-Superior vein in the Nipissing territory, have enhanced the output of the district materially and the general introduction of improved milling methods, with flotation and cyanidation, to the treatment of the low-grade ore, and the fills, dumps, and tailing piles, has prolonged the period of large production much longer than was to be expected in default of successful results from general explorations during the past five years.

At Cobalt itself, in the Coleman and adjacent townships, where the first discoveries were made, this exploratory work has been most intensive. Without particularizing, the general results may be reported as disappointing. Several of the earlier large producers, like the La Rose and the Crown Reserve, have practically closed down. Most of the other profitable companies have adopted a definite policy of spending their funds available for exploration and speculation in other and remote districts. In some cases these companies have desisted from exploring fairly promising ground that belonged to them. During the past two years several of the producing companies have united to employ a geologist to aid them in exploration. It is difficult to measure the direct results of this policy, for as the saying goes, if the ore is found the superintendent or the mine-boss claims credit, and if it is not the expert is "put over the ropes." However, one indirect result has been a thorough and detailed study of the unique distribution of ore in the district, the data and results from which are now available in the reports and articles by Alfred R. Whitman, of California, the geologist engaged for this work.

The explorations made at the King Edward mine and by the Beaver and Temiskaming companies to determine the possibilities of the lower contact-zone of the diabase sill are recent features of local mining development. Deep shafts, 900 to 1200 ft., were sunk to reach a geological objective, first theoretically assumed and then determined by diamond-drilling. The results were geologically a success but commercially unsatisfactory. It is not likely that any of the companies will find courage to undertake such 'long shot' explorations in the face of the indifferent results. The Nipissing company, by unique hydraulic operations, has swept whole hills clean to find outcrops of the veins, and with good results. This wholesale 'trenching' proved justifiable in the Nipissing territory, but the method is not applicable in all parts of the district so there remain large areas in which there are possibilities of outcrops being found.

The most active new exploratory work is under way in two widely separated and geologically different parts of the Cobalt district. In the south-west, the Adanac and other companies are testing the upper Keewatin-diabase contact-zone following strong veins filled with the minerals associated with the silver, namely, the cobalt and nickel arsenides. In a general way this area is attractive



TEMISKAMING MINE, COBALT, ONTARIO. NORTHEAST-SOUTHWEST SECTION PARALLEL TO MAIN VEIN SYSTEM

and some of the present undertakings are likely to repeat the Beaver-Temiskaming record of more than 12,000,000 oz. of silver. The other explorations are in the northwestern part of the district. One, the Genessee, is exploring in conglomerate; and the other work, being done by the Mining Corporation of Canada, is in diabase formation along the Devils Point northwest-southeast fault. These are both important undertakings and the outcome will be watched with interest. The Genessee is following mineralized veins in the Nipissing conglomerate to the contact with the Temiskaming conglomerate and exploring the zones of lateral shearing in relation to these veins in the hope of picking up extensions or duplications of the deep ore in the neighboring properties south-eastward. Cobalt needs a new and startling find to arouse

its operators and outsiders to possibilities as yet unexploited.

In the outlying districts there has been but one notable success in recent years. This is at Gowganda district in the Miller Lake-O'Brien mine. After several years of extensive exploration, with only indifferent results and after the operations by the De Lamar crowd on adjacent property had been practically abandoned, this mine came into bonanza. A vein with native silver and the characteristic associated minerals, 14 inches thick and yielding in car-lots from 2000 to 10,000 oz. per ton, was cut on the diabase about 200 ft. below the contact with the Keewatin formation. Last year a production of 2,000,000 oz. was attained and the probable reserves are estimated at 10,000,000 oz. The result of this strike was the revival of exploratory work in the district, notably in the Miller Lake vicinity. Several companies are developing and there is promise of success for some of them. Other explorations in the Gowganda district have been on the west side of Gowganda lake on the Mann ridge, where there is a defined and extensive diabase area with innumerable characteristic veins from which several finds of moderate size have been recorded. The district is hampered by lack of power and by transportation difficulties from 'the end of the steel' at Elk Lake, 30 miles distant. It is probable that more work will be done in this district and that the results as a whole will prove satisfactory.

In the Elk Lake and Montreal River districts no work is being done, notwithstanding promising conditions in several areas. This is partly due to the financial limitations of the companies interested. It will take a general boom to revive justifiable activity in these two districts.

At the important Casey-Cobalt mine, north of Cobalt, systematic and extensive exploration by drilling has failed to disclose any extensions of the rich veins in this isolated property. South of Coleman township in the Gillies Limit and on Nett and White Bear lakes, several local discoveries have been announced from time to time, but they did not prove to be such as to induce laggard capital to undertake exploitation at this time.

In the South Lorrain district only two serious operations have been under way recently, the Big Keeley and the Wettlaufer-Curry properties. The former, owned by an Australian-British company, has suspended promising development owing to the War, and is only stoping a limited block of ore. Two separate attempts to find more ore on the Wettlaufer mine, which has a record of several millions of ounces, has been discontinued, and it is probable that the demise of this spectacular operation will soon be recorded. The extensive exploration campaign on the adjoining Curry lot has been generally disappointing, and the work may be discontinued. There are several promising properties in this district that need the stimulus boom or a local strike to attract the requisite capital to test them.

The Ontario silver districts will yet yield some spectacular and sensational mines, but the interest and incentive to extensive exploration work has been declining for some time, and can only be revived by new, and probably accidental, strikes such as may come from the continued activities of prospectors and the 'bush-boys', who ever hope to repeat the La Rose-Nipissing episode of an earlier decade.

The Temiskaming Mining Co. has issued a special report to shareholders, containing the reports of the company's consulting engineer, R. J. Ennis, and mine manager, I. S. McReavy, also one by A. R. Whitman on geologic conditions. The report is accompanied by a number of plans.

Mr. Ennis states that as ore-reserves were exhausted in April, 1918, and only a few points were yielding ore, the mill was stopped and all machines put on exploration. From 1908 to 1913, inclusive, 142,818 tons of ore yielded an average of 50.2 oz. per ton, while from 1914 to 1917, inclusive, 91,595 tons averaged 40 oz. per ton. The total was 10,837,919 oz. Development necessary for this output amounted to 39,503 ft. On the levels above the diabase sill within this area, and on the 575, 650, and 725-ft. levels in the diabase, 38,000 ft. was driven, thoroughly prospecting the ground.

Mr. McReavy's report covered the period January 1 to June 30, 1918. He reviews the reports of Balmer Neilly and Douglas Mutch, who examined the mine during the dispute under the previous management. Their estimates were practically correct. During this half-year the mill treated 11,759 tons of ore, yielding 391,368 oz. Development amounted to 1496 ft. Tailing available for treatment is under 70,000 tons, containing up to 300,000 oz. of silver.

Mr. Whitman's geologic report states that there are three unexplored areas on the property in which there are reasonable possibilities of finding ore. The most important is on the 500-ft. level of the Gans lot. The driving of a 280-ft. cross-cut is justifiable. The second area is that between No. 3 and 19 veins, on the 500-ft. level. A small orebody might be cut within 100 ft. of No. 19. The third area is on the 1600-ft. level. Here, there is a reasonable possibility of finding ore. The south-west cross-cut exposes a strong calcite vein in Keewatin formation, which arches up into the lower surface of the diabase, as the veins in the Temiskaming and Beaver mines belong to the same system, and ore should be found. This exploratory campaign will be finished about New Year. The map on the foregoing page shows the workings of the Temiskaming mine.

SPANISH MINERAL EXPORTS for the first half of the current and past two years are as under, converted from pesetas to dollars:

	1918	1917	1916
Copper:			
Blister	$2,115,180	$2,597,540	$2,426,400
Ore	24,030	100,980	99,400
Regulus	1,643,490	1,759,560	1,342,200
Iron ore	6,363,610	6,264,500	5,206,000
Pyrite	2,323,080	2,901,800	4,012,600
Lead:			
Argentiferous	1,035,180	1,237,720	869,000
Other	5,697,540	5,387,140	6,412,000
Quicksilver	571,590	210,100	1,267,000

On the average price ($116) of mercury for the first half of 1918, Spain exported 4920 flasks, considerably more than in 1917, but much less than in 1916.

ADVENT BAY, SPITZBERGEN

Spitzbergen

A recent cablegram from London stated that the German holdings on Spitzbergen had been seized for the Allies by a British naval unit and reference was made to the fact that this island belongs to no country—it is a *terra nullius,* or 'no man's land'. Some of our readers are aware that Spitzbergen boasts deposits of excellent coal that have been exploited for about ten years by John M. Longyear, of Lansing, Michigan, in the name of the Arctic Coal Co., which was producing 70,000 tons per annum just before the War. This product was sold at the Scandinavian and Baltic ports, but it represented a precarious trade. The inability to deliver coal to Russian and German ports, together with the abnormal increase in the value of the ships operated by the Arctic Coal Co., led to a sale of the vessels, putting a stop to this interesting enterprise, for which Scott Turner, at one time news-editor on the 'Mining and Scientific Press' and now an officer in the U. S. Navy, was resident manager. Just before the War he had taken steps to draw the attention of the European Powers to the desirability of creating some form of international government for the island, because, among other reasons, it was becoming increasingly difficult to deal with recalcitrant labor. Any disputes arising therefrom were tried at Tromsö, the nearest port, in Norway, but this was proving unsatisfactory. In 1912 at an international conference at Christiania it was suggested that a joint control of the island be vested in Sweden, Norway, and Russia; but that came to nothing because England and Germany were not included. Later, it had been arranged by the governments of England, Germany, Russia, and others, to send representatives to a meeting in August 1914 for the purpose of arranging details, but this, of course, was indefinitely postponed by the beginning of hostilities. W. S. Bruce, when reading a paper before the British Association for the Advancement of Science, in 1913, urged his government to annex the island, but the suggestion was ignored, properly. The mention of his name recalls the fact that he was one of the numerous pseudo-heroic Arctic explorers that used to give Mr. Turner so much trouble in rescuing them. Sundry German scientists went through similar motions and would return home with vivid yarns about their 'farthest north', for Spitzbergen extends to Lat. 80° north, bringing it within 650 miles of the North Pole. During summer excursion steamers used to visit Advent bay, where the Arctic Coal

MAP TO SHOW THE POSITION OF SPITZBERGEN

Co. had its headquarters, yet the island has loomed large in the stories of exploration read before various scientific societies, particularly in Germany. Mr. Turner found himself called upon many times to rescue heroic explorers that had lost their way, almost within hearing of the whistle that called the miners to work in the coal mine.

We reproduce an old photograph of Advent bay. It is taken so as to look up Longyear valley and shows the west side of that valley, with the tramway leading to the entry of the Arctic Coal Co.'s No. 1 mine. A glacier appears at the head of the valley. The photograph shows that the coal measures lie nearly horizontal. The upper tunnel of the tramway is about 100 ft. below the outcrop of the principal seam of coal, which is of Tertiary age. The slope shows strata ranging in age from the Carboniferous to the Eocene.

Advent bay is at the extreme south-eastern tip of the Ice fiord, on the west coast of the island of West Spitzbergen. As the map shows, Spitzbergen is an archipelago with a total area of about 33,000 square miles.

The German holdings, to which reference was made in the daily press, are of no consequence. They consisted of a small meteorological station at Ebeltoft Harbor, near King's bay, where a couple of bewhiskered and bespectacled German scientists used to spend the winter, recording temperatures and wind-velocities, and trying to determine by observations how high above the earth the Northern Lights coruscated. This camp consisted of two or three small huts, including a home-made wireless plant, effective for a radius of not more than 50 miles, or less than one-tenth the distance to Norway. It was used to keep in touch with the big station at Green Harbor, where the Norwegian government had erected a wireless plant under agreement with, and contract from, the Arctic Coal Co. which represented the only noteworthy industrial enterprise in Spitzbergen.

FILTER LITIGATION is agitating metallurgical circles in Western Australia. The present suit is between the Moore Filter company and the Great Boulder Proprietary company at Kalgoorlie. The former alleges infringement of its patents; the latter denies this, claiming that the Moore patent is an amalgamation of four inventions, patented in America. The case is likely to be a protracted one. The Great Boulder company, which is the most profitable gold mine in Australia, treats each month 16,000 tons of sulpho-telluride ore yielding $14 per ton, making a profit of $115,000 therefrom. The process is reduction in Krupp ball-mills, roasting in Edwards furnaces, grinding in pans, agitating in mechanically-operated vats, and filtering on Ridgway machines. This filter consists of two rectangular V-bottom tanks, one containing slime, the other cyanide solution. Suspended on balanced arms is a basket of filter-leaves. By an ingenious arrangement this is lowered into the slime. The cake is quickly formed—four minutes or so with roasted ore. Then the basket moves through an arc of 180° when lowered into the solution, where it is washed for 20 minutes. Then the filtered material is lifted to a vertical position and blown-off into a discharge-launder. The Ridgway filter is also used at several other mines, where raw slime is treated successfully.

Manganese in Utah

The U. S. Geological Survey has made public a statement referring to manganese ores in Utah. Manganiferous deposits are rather generally though somewhat sparingly distributed over Utah. Most of the deposits now known are in the Green River and Tintic districts, but reports indicate that many other deposits occur elsewhere, most of them at places rather remote from railroads. The available information suggests that a line drawn diagonally south-westward through the centre of the State would separate areas that contain deposits of two distinctly different types. Practically all the known deposits west of this line are derived from quartz lodes of deep-seated origin. The ore is highly silicious, and most of it needs some degree of concentration or beneficiation to make it marketable. Most of the deposits east of the line are of sedimentary origin, lie flat, very near the surface, or even upon it, and generally need only careful mining to yield a very high grade of ore.

Manganese ores occur in several places in the area that extends from Utah Lake south-westward 75 miles or more and that embraces parts of Utah, Tooele, and Juab counties. Most of the development work has been done in the central part of this area, in the Tintic and West Tintic or Erickson mining districts. The deposits elsewhere are reported to be wholly undeveloped or opened only by shallow workings. Several manganese deposits are partly explored by workings made during the last forty years in search of silver and lead ores. Small amounts of manganese ores and manganiferous iron ores have annually been produced in the Tintic region for use as flux in lead and silver smelters. Among the older mines in which manganese ore has been explored are the Tip Top tunnel, at Homansville, and the Black Jack group, in the West Tintic district. Both are now producing high-grade manganese ore. Other mines in which considerable bodies of manganese ore are found are the Baby Elephant group, Queen Mary, Indian Boy, May Farmer, and Eutonia. Undeveloped outcrops of manganiferous material similar to that of developed orebodies are numerous. Up to the end of June 1918, about 1400 tons of manganese ore had been shipped, the average assay being 38% manganese and 10% silica.

ALUMINUM ALLOYS may be analyzed as follows, according to A. W. Willis: To determine Mn, dissolve 1 gm. in 25 to 30 cc. of HNO_3 (d. 1.2) plus one drop of HF, and proceed by the bismuthate method, the HF having no detrimental effect. In determining Ni by the glyozine method, dissolve the alloy in dilute HCl plus 1 or 2 drops of HNO_3 to dissolve the copper residue. Dilute, add 10 gm. of tartaric acid, and, when dissolved, add a suitable amount of dimethylglyozine solution; make ammoniacal, and let stand; filter through counterpoised papers, and dry and weigh. For copper the KI method is more satisfactory than the KCN process.

SAN FRANCISCO

Exemptions and Furloughs for Mining Men.

The Federal government has made provision for retaining in industrial work such men as are necessary for the various essential industries. Under the most recent ruling of the War Industries Board, Priorities Division, the production of metals and ferro-alloy minerals is made essential under Class 2. The following facts and suggestions are offered for Californian mine operators as to the proper course to pursue to prevent the loss of such of their employees as cannot be replaced.

District draft-boards in the present draft, in considering claims for deferred industrial classification, will have to assist them a board composed of three advisors—one representing agriculture, one industry, and the other professional. The industrial advisor of each district board has been or will be advised by the various authoritative bodies at Washington of the essentiality of the various industries, and the essential occupations connected with such industries.

The industrial advisors for the State of California are:

Name and Address	Dist. Board and Headquarters
E. J. Fowler, San Francisco.....	Northern No. 1, San Francisco
Thomas Pollard, 112 Market St., San Francisco	Northern No. 2, San Rafael
A. Galloway, Sacramento.....	Northern No. 3, Sacramento
Dr. J. R. Haynes, Los Angeles.....	Southern No. 1, Los Angeles
Elias J. Emmens, Bakersfield.....	Southern No. 2, Bakersfield

The first step in order to prevent the loss of an essential employee is to get in touch with one of the above industrial advisors and endeavor to secure exemption on industrial grounds.

In the event of failure to secure exemption on industrial grounds, then and then only should an effort be made to secure a furlough. A furlough cannot be secured for any man who has not already been inducted into the military service, or is either in or on his way to a military camp. Requests for furlough must come from employers.

Van H. Manning, Director of U. S. Bureau of Mines, has been appointed by the Secretary of Interior to certify to the War Department all applications for indefinite furlough for return to metal mining and metallurgical industries of enlisted men in the Army. To facilitate such certification and in order to secure an opinion based upon the particular case involved and the attendant local conditions, the country has been subdivided into districts with a certifying advisor for each district.

Edwin Higgins, 625 Market St., San Francisco, has been appointed District Certifying Advisor for California. Working in co-operation with him, as assistant-advisors, in the districts indicated, are the following: N. S. Kelsey, Jackson, Amador county; P. C. Knapp, Alaska Commercial Bdg., San Francisco; and T. E. Graff, Redding.

Having failed to secure exemption and being desirous of securing a furlough for an essential man, the employer should get in touch with the nearest Assistant-Advisor.

The general classes of men who will be considered for certification for furloughs are:

1. Those engaged in management and superintendency, including dredge-masters.
2. Highly trained technical men.
3. Skilled mechanics, including crane-men and operators of automatic (smelter) machinery, steam-shovel operators, and hoist-men.
4. Drill-runners and timber-men.
5. Head furnace-men, including magnesite-burners, and first helpers.

CRIPPLE CREEK, COLORADO

Several Promising Discoveries.

A surface discovery of importance has been made on the property of the Isabella Mines Co., on Bull hill by Eden Beebe of Cripple Creek and Harry Nelson of Victor, lessees. Prospecting north of the old Maloney shaft on the Orphan Belle, these operators have opened up in virgin ground the extension of the rich Maloney vein and at a depth of about 18 ft. they are mining ore carrying both rusty gold and sylvanite. The ground is virgin to a depth of 500 ft., and from the present showing the lessees will take out a fortune if the ore persists to that depth.

The Ramona, a claim owned by the Ramona Gold Mining Co. on Bull hill, and idle for many years, is the scene of a promising discovery by lessees. At a depth of 80 ft., ore running from $14 to $35 per ton has been opened up and shipments will start during the present week.

The Reva Gold Mining Co., operating the Rose Nicol on Battle mountain, is constructing an aerial tram from the mine to the loading-station on the Midland Terminal railroad in Eclipse gulch, and building a modern six-bin ore-house preparatory to heavy production. The Rose Nicol shaft has been sunk to a depth corresponding with the 100-ft. level of the Portland No. 2 shaft, with which the Rose Nicol workings have been connected and the 1200-ft. level of the Dexter mine on Bull hill. Capital from Jacksonville (Florida) and Johnston (Pennsylvania) controls the Reva Gold Mining Co., operating the mine under a six years lease from the Rose Nicol Gold company.

The Lincoln Mines & Reduction Co. has installed electric lights on its leased property on Ironclad hill and two shifts are now working on a body of manganese ore recently uncovered. Machinery is ordered and construction plant on the concentrator has commenced.

The Strong mine, on Battle mountain, one of the richest of the old producers, with a record in excess of $10,000,000 gross from the 8 acres contained in the Strong mining claim, will close down at the end of the month. The shutdown is attributed to labor shortage.

TORONTO, ONTARIO

Stimulating Prospecting.—Road to Boston Creek.—Dumps at Cobalt.—Mining School at Haileybury.

The Ontario Department of Mines is taking an active interest in the problem of providing suitable employment for returned soldiers. As a large number were engaged in mining and prospecting prior to enlistment, it is believed that more suitable opportunities could be offered them than those presented by the opening of new fields for exploitation. With this object in view, Cyril W. Knight, A. G. Burrows, and other officials of the Bureau of Mines are engaged

in investigating and mapping the geology of the territory lying south and west of Lake Abitibi in northern Ontario. This area includes the Lightning River field and Rickard township, where promising discoveries have been made. It is hoped that the work will be completed in time for the map to be issued for use by prospectors early in the spring. Another discovery has just been made at Lightning River, a 4-ft. vein showing visible gold having been found on the Ferron claims, one mile from the Howie-Cochenour property.

Boston Creek.—Government engineers have started surveys for a new road to be constructed as soon as labor can be obtained. In addition to serving the Boston Creek field, it will open the adjoining township of Skead, passing through country believed to offer great possibilities.

Kirkland Lake.—Plans for extensive development of the Ontario-Kirkland mine have been arranged. The main shaft will be sunk from 100 to 300 ft., at which depth 1500 ft. of lateral work will be done. A number of strong and well-mineralized veins have been uncovered on the surface.

Cobalt.—Upward of 10 cars of ore have been shipped from old dumps of the Foster mine, the average silver content of which is 10 oz. per ton. The dumps contain 13,000 tons, some of which is high-grade. This is being sorted out. Underground work is being done on the upper levels.

Haileybury.—A new mining-school has been opened here with machinery valued at $30,000, much of which was donated by Cobalt mining companies. It is managed by a board representing several companies, and has a teaching staff of six, all of whom have had extensive mining experience. Thirty-five pupils have been enrolled so far.

SUTTER CREEK, CALIFORNIA

Central Eureka and Old Eureka Mines.—Wages Raised.

Recent developments at the Central Eureka mine are most encouraging. A winze started recently on the 3500-ft. level, 100 ft. west of the shaft, has reached a depth of 17 ft. on the new orebody. At the bottom of this winze the vein has a width of 14 ft. It not only shows free gold, but carries considerable high-grade sulphides. Assays show the average value exposed to be over $25 per ton. The fact that the walls are well defined, and the hanging wall becoming harder with depth, speaks well for the persistence of this ore. The foot-wall carries a 3-in. gouge seam, which is a favorable condition not encountered above. Work is to be continued vigorously in this winze as soon as the erection of a small air-hoist is completed. This machine, in place of the 'tugger' hoist so far employed, will not only speed-up work in the winze but permit of other work on the 3500-ft. level, with less interruption. A good grade of ore has also been opened in the north stope on this level. The grade appears to be improving, as it is being opened toward the north boundary or in the direction of the Old Eureka mine. The importance of the development of a new orebody in this direction is shown by the fact that over 3000 ft. of Central Eureka ground above this point has never been prospected, though old records prove that a shaft sunk years ago near the north boundary cut a vein from which good milling ore was extracted and hauled to neighboring plants for treatment. The belief that this is an entirely distinct body from anything worked through the present shaft seems well founded. The ore comes in at an angle of 60° from the line of the stope, and has a dip to the west of 75 to 80°, while the vein on which the stope was started dips 75° to the east. Development at this mine has been seriously retarded by lack of labor and high costs, and as an added burden, the closing down of the adjoining South Eureka mine during the spring made it necessary for the Central Eureka to bear the entire expense of keeping both mines unwatered, as the joint pumping-plant is in the South Eureka shaft. Repairs to the South Eureka shaft, pumps, and electric machinery have been costly, but that portion of the plant is now in such shape that expenses there will from now on be materially reduced. The property gives promise of keeping the mill supplied with ore of good grade for a long period. Other promising prospects in the mine will be developed as soon as opportunity permits. The executive staff of this property consists of Albion S. Howe, superintendent; Henry Warrington, assistant; and W. J. Bryant, mine foreman. The main office of the company is in San Francisco.

The shaft at the Old Eureka mine is 2700 ft. deep 550 ft. below the bottom of the shaft, as it stood when the present company took over the property. In addition to the 550 ft. sunk of the proposed 1000 ft., the new owners enlarged the old shaft from 1600 to 2150 ft., from two to three-compartment size, and repaired the shaft throughout. Although short-handed, there has been no cessation of work. While sinking continued, other men were engaged in cleaning-out old drifts and cross-cuts and extending them. As a result of this work, some good ore has been developed, particularly on the 2100-ft. level. During the first few weeks work, the ore appeared in small lenses, but within the last ten days a well-defined vein has been found, upon which work is progressing. While specimen ore has been taken out of this shoot, it has not yet been sufficiently developed to form any estimates, but this, together with conditions on the 1600 and 1200-ft. levels, give the owners reason to hope for good results in the future. It is not likely that any new levels will be opened below 2100 ft. until after the shaft has reached a depth of 3100 ft. This point will be reached in a comparatively short time, judging by present progress. Shaft work is being done under contract, while other work is being done by day labor. T. Walter Beam is superintendent, and T. J. Donovan is in charge of underground work.

On October 1 a 50-cent raise to miners and timbermen went into effect at all mines in this county, and shovelers, carmen, and top hands had their pay increased at various mines from 25 to 50c. per day. This move is considered a war measure, deemed necessary in order to offset the alarming shortage of labor.

MEDFORD, OREGON

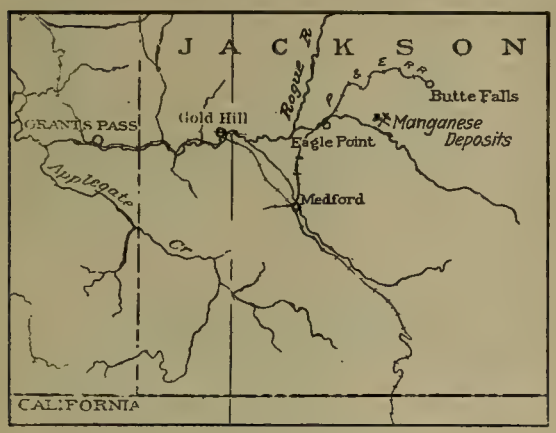
Manganese Deposits, Their Extent and Value.

An examination of a large number of manganiferous deposits in Oregon, including a reconnaissance of 150 square miles near Lake Creek, was made in July 1918, by J. T. Pardee, of the U. S. Geological Survey, in company with Henry M. Parks, director of the Oregon Bureau of Mines and Geology. Mr. Parks placed at the disposal of Mr. Pardee the results of his previous work in this area, and both are responsible for the estimates and conclusions given.

So far as known the manganiferous deposits of the Lake Creek district are confined within an area of 150 sq. miles in the east-central part of Jackson county. The area is rather sparsely settled; farming is the principal industry. The nearest large town is Medford, 15 miles directly southwest of the deposits, but nearly twice that distance by the available roads. Eagle Point, a town on the Pacific & Eastern Railway, is the most convenient shipping-point. The surface of the region is hilly and in places mountainous, but only moderately rugged. The local relief ranges from a few hundred to 2000 ft. or more; the general elevation is between 2000 and 2500 ft. Streams are numerous, though most of the smaller ones become dry in summer. The climate is mild, and the year is made up of a wet and a dry season. Most of the rather heavy winter precipitation falls as rain. The greater part of the surface that lies below 2500 ft. is covered with a mixed growth of madrona, manzanilla, and chapparal bushes, and rather scrubby oaks. At higher elevations, fir and pine trees are abundant. About

1500 tons of ore, containing at least 15% Mn, is available. In addition, incomplete prospecting by drilling and open-cuts indicates that at least 4 acres are probably underlain by 10 ft. of ore (120,000 tons) containing probably 10% Mn. Surface indications in other parts of the district warrant an estimate that they may yield 130,000 tons more of material carrying at least 10% Mn, so that the probable reserves of ore of this grade amount to at least 250,000 tons.

Manganese mining is a new industry in the Lake Creek district, actual development having been started late in 1917. Since October of that year the Manganese Metals Co. has explored by open-cuts and drill-holes, 3 or 4 acres on the Tywell ranch, 5 miles south-east of Lake Creek post-office, and has erected a mill capable of dressing 20 tons of crude ore in 24 hours. This mill has been in operation intermittently since March 15, 1918, and has produced concentrate that averaged 45% Mn. Four tons of crude ore yielded one ton of concentrate. Since this company began work the known limits of the manganiferous area have



MAP OF PART OF OREGON

been considerably extended by prospectors, and a large number of claims have been located.

The cost of hauling concentrate by teams from this mill to rail at Eagle Point is now $4 per ton. At a moderate expense the roads could be made usable for heavy trucks throughout the dry season—from April to November. Water for working many of the deposits can be obtained almost throughout the year without great expense, and timber for mine and mill construction is within easy reach of most of the mines. Wages are $5 or more per day, and mining supplies are as expensive as they are elsewhere in the North-West. Electric power is available from a transmission-line passing through Eagle Point.

Options on several claims, including the larger part of the holdings of the Manganese Metals Co., have recently been obtained by Victor Rakowsky of Joplin, Missouri. He has arranged to begin working the deposit on the Tywell ranch by churn-drilling, and has taken steps to obtain water and machinery sufficient to work on a large scale such orebodies as he may find. He will probably have demonstrated the value of his property and of his other options within a few months. His plans contemplate at least one mill having a daily capacity of 500 tons of crude ore, which is to be in operation before the end of 1918. Unless some unforeseen contingencies arise, the mill of the Manganese Metals Co. will no doubt continue production indefinitely at its present capacity. The results so far obtained by Mr. Rakowsky on a test shipment and by the Manganese Metals Co. show that a high-grade manganese concentrate can be profitably made from the ore at the Tywell mine and presumably from that at the other Lake Creek deposits.

LARAMIE, WYOMING

The Exploitation of Manganese Deposits.

There are few known deposits of manganese ore in the State of Wyoming. A deposit in the northern part of Albany county was examined by E. L. Jones, Jr., of the U. S. Geological Survey, on October 5, 1917. The deposit is being exploited by the Wyoming Manganese Co. of Laramie. At the time the deposit was visited no ore had been shipped, although 200 tons, containing 40% Mn, was on the dumps. Later in 1917, 30 tons of high-grade ore was shipped to a mill at Boulder, Colorado, for experimental purposes. Development consisted of 200 ft. of tunneling connecting with a shaft 25 ft. deep. The mine is on a gently-sloping mesa on the western flank of the Laramie mountains, near the head of Sheep creek, at an elevation of nearly 8000 ft. It is accessible from Medicine Bow, on the Union Pacific railroad, by a fair wagon-road 38 miles long. The manganese is associated with a bed of chert from 1 to 8 ft. thick, intercalated in beds of pink or maroon limestone and thin interbedded sandstone. The minerals are the oxides, manganite and pyrolusite, which have wholly or partly replaced the chert or extend for short distances into the enclosing wall-rocks. Much of the ore consists of fern or tree-like aggregates of pyrolusite in the chert. The silica that was replaced is re-deposited in bluish opaline masses. Cavities in the ore are lined with beautiful sparkling crystals of manganite and here and there with tabular crystals of barite. The ore contains little iron. The workings show that several thousand tons of manganiferous chert is available for mining. Much of this material is too silicious, but considerable ore containing 40% Mn could be hand-sorted and marketed with profit. The company has experimented with several processes to concentrate or dress the ore, but has not yet reported the results of its experiments. The deposit may prove to be a source of ore for use in dry batteries and in chemical work. Much of the ore is pyrolusite, reported to contain less than 1% of iron. The manganese deposit appears to be of sedimentary origin, and the original manganese minerals were probably deposited with the chert. Black chert is scattered over a large area near the mine, and probably other manganese deposits will be found in its vicinity.

MONTEREY, MEXICO

Improvements in Many Districts.

Mining and metallurgical operations continue to show improvement in practically all of the larger districts of Mexico, with the exception of those that are more remotely situated in the states of Durango and Chihuahua. Many of the larger American mining companies are preparing to bring their properties up to the normal state of production that existed prior to the revolution. It is announced that the American Smelting & Refining Co. plans not only to bring its several smelters and mines in Mexico up to their former outputs but that it has appropriated $4,000,000 to be expended in enlarging its operations. The railroad situation is the most serious hindrance to a general resumption of industrial activities. The lack of equipment and the poor physical condition of the various lines comprising the National Railways of Mexico, now officially called the Constitutionalis Railways of Mexico, makes it difficult for many mines and manufacturing plants to carry on their business.

TEXAS

Marfa.—Preparations are being made by the Capote Nitrate Co., recently incorporated with a capital of $100,000 and head office in San Antonio, to develop a nitrate deposit near Marfa. According to the charter of the company its purposes are to "mine and manufacture nitrate of potassium and sodium nitrate." The incorporators are Alfred Dueler, G. C. Simpson, and J. B. Herff, all prominent business men of San Antonio.

ARIZONA

Bisbee.—The high wage-scale of the Warren district—$6.10 per day for miners and $5.85 for shovelers—which has been in effect since August 1, is particularly emphasized by a comparison with the Michigan scale recently announced for October 1, according to the 'El Paso Herald'. In comparison with the $6.10 rate for miners, the highest rate for miners in Michigan is $5.10 per day; while shovelers in Michigan are receiving $4.80, compared with $5.85 received by these workers in the Warren district. There is even a greater difference in the wages of timber-men, these men in Michigan receiving $4.25 per day, against $6.10 in Arizona.

Jerome.—The Grand Island mine has resumed sinking from 300 to 535-ft. depth.

United Verde Extension yielded 4,720,000 lb. of copper in September, a decrease.

The Tillie Starbuck Mining Co. has since its organization built a road to the mine and driven 1000 ft. of cross-cut which it is estimated is now 40 ft. from the orebody. The Verde Squaw shaft has reached a depth of 100 ft. and a No. 5 Cameron pump has been installed. The United Verde Extension will distribute the quarterly dividend of 75 cents per share on November 1.

Kingman.—The cross-cut at the 200-ft. level of the Rico mine has cut nine feet of ore, 30 to 36 inches of which will pay to ship.

Metcalf.—The Shannon Copper Co. produced 722,000 lb. during September.

Miami.—The Inspiration Consolidated has declared a regular quarterly dividend of $2 per share payable on October 28.

Nogales.—The mill at the Worlds Fair mine has been completed and is now in operation.

Phoenix.—Sixty managers of smaller properties in this State held a meeting here on October 19 to aid in the passage of Amendment 100, which will give a new workmen's compensation law. At present, damage claims have no limit, as no definite awards are set for injuries. Protests were made against Federal taxation of new producers, and against the proposal to take equipment from development properties and put it on producing mines.

The assessed valuation of Arizonan producing mines for the fiscal year 1918-'19, as fixed by the State Tax Commission, amounts to $421,963,854, an increase of more than $90,000,000 over that of the preceding year. These figures may be taken as indicating the growth of the mining industry, but this in fact is but partly true, according to the 'El Paso Herald'. In their larger significances they show conclusively a State taxing power, which apparently has become a fixed policy to compel the mining industry to contribute a larger and ever-increasing proportion of the revenues for the support of State and county governments. The figures above cover only the valuation of the producing mines of the State. In 1912-'13 the assessed valuation was $45,145,084; in 1917-'18 it was $393,421,537, an increase of 873%.

Prescott.—The Victor & Bell Crown property, which has been dormant for several years, is being developed by Rochester capitalists. This property is near the Cunningham Pass mine. Four thousand feet of development was done before the property closed down. An adit is now being driven 200 ft. below the old workings.

Ray.—H. E. Easterday has filed a complaint against W. E. Codgell and has asked that a receiver be appointed for the Ray-Kelvin Mining Company.

Salome.—J. B. Marlin, manager for the Yuma Warrior Mining Co., announces that the company has been financed for extensive development work on the old Harqua Hala property, which produced considerable gold in the past. The Victory Queen Mining Co. is developing a gold property in the Little Harqua Hala mountains three miles south-east of the mine of that name. Development at the Little Giant continues, two levels now having been opened. At 115 ft., the present lowest level, 300 ft. of driving has been done. From development work alone ten cars of 12 to 21% copper ore has been shipped. Sinking is to be continued and stoping is under way on all levels. The rich ore is in a vein varying from 5 to 48 inches in width.

Silver Bell.—The El Tiro mine in this district of Pima county is again becoming a large producer. Under the management of Percy Williams, it is shipping 36 cars of 6% red-oxide copper ore per month to the smelters at Sasco and Hayden. It is predicted that shipments will be increased to three or four cars daily early in 1919. The present output is 175,000 lb. per month. From 75 to 100 men are employed. El Tiro is a neighbor of the A. S. & R. Co., which is operating at Silver Bell and owns the Sasco smelter. El Tiro is operated under lease from the receiver, M. P. Freeman of Tucson. The property is well equipped with machinery. Electric power is obtained from Sasco. Mr. Williams opened this mine for the owners and developed the district 20 years ago. He returned to Silver Bell last fall.

Superior.—Magma Copper produced 747,805 lb. in September, considerably below previous returns.

Tucson.—The State Bureau of Mines is to commence a geologic survey of Arizona, to be in charge of O. P. Jenkins.

The Zonia Mining Co., and the holdings of the McMahon Bros., have been acquired by a Tucson syndicate. The Zonia property has been idle for some time but the McMahon has been a regular shipper for several years.

Wenden.—The Little Giant and Critic mines continue to make regular shipments of copper ore. That of the Little Giant carries 20% Cu.

It is expected that work will be started soon at the Wilkinson, American Flag, Vindicator group, also the Jerry group. Gold properties in this district are still inactive.

CALIFORNIA

San Francisco.—Reports filed with the California State Mining Bureau for the week ended September 28, show 11 new wells ready to drill, making a total of 563 wells reported since the first of the year. Although new wells reported are the principal indicator of what may be expected toward maintaining the oil production of the State, a study of the detailed report of proposed deepening and re-drilling

operations, of which there were nine listed during the week, throws some interesting sidelights on what is being done, and what can be done, toward increasing production of petroleum by decreasing the amount of water, that it is necessary to raise to the surface, in some fields. An example of such remedial operations is given this week in the notice of intention of Union Oil Co. to deepen well No. 5, Squires, in the old Santa Maria field. The proposed deepening operations will take this well into the third oil zone of the Santa Maria field, and are in line with similar operations, carried out in a number of wells, during the past three years, whereby not only a clean and profitable production has been obtained, but large quantities of water have been eliminated. The total figures for the quantities of water being produced in various fields of the State, as given in the recently-issued second annual report of the State Oil and Gas Supervisor, R. P. McLaughlin, are worthy of careful consideration by all those who are interested in increasing the production of oil and reducing the cost.

The report showed the following for June 1917:

County	Oil, bbl.	Water, bbl.
Los Angeles and Orange	1,396,020	321,840
Ventura	81,840	31,620
Santa Barbara	477,408	207,135
Coalinga field	1,282,602	313,138
Other fields	3,237,870	873,735

Darwin.—Nine miles from this place in Inyo county, and 34 miles from rail at Keeler, is the Utacala Exploration Co.'s zinc mine, according to G. H. Ryan in the Salt Lake 'Mining Review.' The ore is mostly hydro-zincite, averaging 40% zinc and 12% moisture. Some lead ore is found, but is kept separate from the zinc. The orebody is a replacement of limestone, occurring along the intersections of two fracture-zones. In order to lessen haulage charges, a calcining-plant was erected in May 1918. This briefly consists of a vertical kiln, in which the ore and coal are fed in layers, the fuel being 6% of the weight of ore. Care must be exercised not to get the temperature too high, as zinc would be volatilized. The grade of the ore is raised to 53% zinc. The cost of calcining is from $3.20 to $4.50 per ton; the value of the ore increases from $22.50 to $38.10; and the shrinkage during calcining is 22%. The kiln treats 8 tons per 24 hours.

Downieville.—The Loftus Blue Lead Mines Co. of Los Angeles has applied to the State Water Commission for a permit to use 50 cu. ft. per second of the waters of Little Canyon creek, tributary to Canyon creek, in Sierra county, for hydraulic-mining purposes. Water is to be diverted by means of a wooden dam 10 ft. high, 40 ft. long on top, and 20 ft. long on bottom, already constructed, and will be conveyed to place of use by main ditch 4 miles long. Water will be returned to Slate creek above where Canyon and Slate creeks join, after use. The cost of proposed work is $10,000.

COLORADO

Cripple Creek.—The Gold Dollar company's indebtedness has increased to $16,310, and an assessment of 1c. per share has been levied. Lessees paid fair royalties, but insufficient to pay all expenses. The lessee at the main shaft ceased work a year ago, and nobody has taken it on since.

Jamestown.—The Warren mine is now sending to the Wano mill 25 tons of 50 to 65% fluorspar daily, where the grade is raised to 90% CaF_2. The concentrating-plant eliminates the silica and other impurities.

IDAHO

Hailey.—The Federal M. & S. Co.'s North Star mine is closed pro tem, as there is no demand for its ore. The Independence mine, near by, is producing 100 tons of ore daily.

Kellogg.—The Caledonia company pays 3c. per share, $78,150, on November 5. One more dividend of 3c. will be paid, after which the rate will probably be reduced. The September profit was $35,000.

Mullan.—The Federal M. & S. Co.'s Morning mine is producing 1000 tons of ore daily. In August the rate was only 300 tons; two years ago it was 1600 tons.

The Hickory mine, twin claim to the You Like mine of the Federal company, is to be developed by the Old Hickory Mining Co., just organized by Oscar Nordquist, president and manager; O. A. Olin, vice-president; H. H. Ross, secretary-treasurer; Walter Hanson and H. B. Kingsbury, all of Wallace, Idaho, directors. The Hickory is about the last of the early and rich discoveries in this mineral belt to be developed. It was located in 1891 by W. Clark and J. Helmil on the same day as they located the You Like mine, which has been very profitable to the Federal company. The Hickory has been sought by the Federal and other large operators, but only in the last month was consent to a sale obtainable from all of the owners. Some old surface workings and shafts show rich silver ore.

Porthill.—The Idaho-Continental has shipped 77 cars of ore and mill products valued at $231,000 since July 17. Crude ore carries 58% lead, concentrate about the same, and slime up to 70%. All contain over 22 oz. of silver per ton. Auto-trucks haul the ore to rail, a distance of 26 miles, but sleighs will be used in winter. To increase the power supply, a 14,000-ft. ditch has been dug to divert certain creeks. A 2000-ft. aerial tram is to be erected by the Riblet company to span the Kootenai river, thus dispensing with the present ferry. There are 150 men employed, in charge of A. Klockman.

Wallace.—The Wallace 'Miner' states that three companies, all under management of C. L. Hewitt, are profitably treating old tailing in widely-separated points of the district. The North Idaho Metals Co. is operating on the river about half-way between Wallace and Mullan. In the summer of 1917, 10,000 tons of tailing had been impounded in a settling-pond, assaying 5.5% lead, 5.5% zinc, and 2 oz. silver. After much experimenting a process was evolved to separate the lead and zinc by flotation, producing a concentrate averaging 60% lead and 3% zinc, and another containing 35% lead and 12% zinc. The plant has a capacity of 90 tons per day, from which is produced 4½ tons of lead and 5 tons of zinc concentrate. During 1917 the gross value of shipments was $40,000.

The Mullan Milling Co. has a lease on the old Ontario dump, in Government gulch, below Kellogg. This company recently completed a mill of 150 tons capacity. The process includes fine crushing and flotation. During the few weeks the mill has been running, operations have been largely experimental, but results have been so satisfactory that large profits seem assured. The lead-silver dump under lease is estimated to contain 150,000 tons.

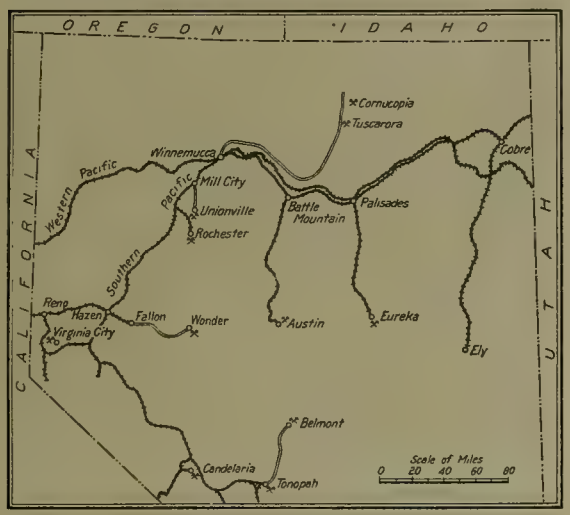
The Spokane Metals Recovery Co. is preparing to rebuild its plant on Nine Mile, recently destroyed by fire. The company had invested $22,500 in this mill. Its equipment consisted of rolls, jigs, tables, and flotation cells. A ball-mill had been ordered, but fortunately had not arrived when the fire occurred. The site of this mill is on the east fork of Nine Mile, just below the large tailing dump from the Rex mill while operated by the Tamarack. The mill was new, having been running only a few weeks and had demonstrated its adaptation to recovering the metals of the tailing. It is believed that most of the machinery can be used again, and the company proposes to re-build the plant at once, adding to it a ball-mill and probably other equipment.

NEVADA

Beatty.—A large plant has been erected, at a reported cost of $100,000, to recover silica from ground owned by the Western Silica Co., 9 miles from Beatty, in southern

Nye county. This company has acquired 22 lode claims. It is said that grinding is the only treatment required to produce a marketable product.

Belmont.—The Nevada-Wonder company has 25 men engaged in unwatering the old Monitor-Belmont mine here, under the direction of E. E. Carpenter, manager for the Nevada-Wonder. The water has been lowered to a depth of 240 ft. Work is in progress at the 200-ft. level through the Belmont and Highbridge shafts. The working-force will be increased as the unwatering drains deeper levels.



MAP OF CENTRAL NEVADA

The old court-house at Belmont has been acquired by the company and restored for use as a club and living quarters for employees.

Ely.—A 15-ton mill is being erected on the Shepherd tungsten mine in the Regan district, north-east corner of White Pine county. O. E. Roodhouse, formerly manager of the O. S. Tungsten mine, south of Osceola, is in charge.

The Holmquist manganese mine, 9 miles south-east of Ely, continues to ship a good deal of high-grade ore.

At an elevation of 6500 ft. on the eastern slope of the Shell Creek range, 30 miles north-east of Ely and 22 miles from McGill, is the property of the Muncy Creek Mining Co. Auto-stages run three times a week from Cherry Creek, a station on the Nevada Northern line, to Aurum. C. D. Ray and others of Utah formed the present company, and have worked the mine for a year, shipping enough ore to pay for the property. The last carload assayed from 15 to 24% copper and 20 oz. silver per ton. M. E. Basset of Fruitvale, California, sold his long-held interest to these people. The mine is well equipped, and is said to show good prospects of developing into a large producer.

Goldfield.—A large pump is now at work at 800 ft. depth in the Grandma, and development at depth can continue.

Lessees working in a winze sunk below the 65-ft. level of the C. O. D. mine have ready a lot of $30 gold ore; and recently shipped a car of $18 copper-gold ore from the 200-ft. level.

Thompson.—Mason Valley produced 1,471,442 lb. of copper in September. This is the largest output since May.

NEW MEXICO

Lordsburg.—The Bonney Mining Co. is again operating its mine, as the lease held by the Lawrence Mining Co. expired on September 15. The lessees opened rich ore on the 500-ft. level, and since May sent 66 carloads to the Copper Queen smelter at Douglas. All 2½% ore was left on the dump. Twenty men are working in charge of J. P. Porteus and K. K. Trendt.

Mogollon.—The Socorro Mining Co.'s mill is treating 200 tons of ore daily. The September output was 25,000 oz. of silver and gold.

The Oaks company has ordered a 1200-ft. surface tramway to be built from its new central shaft to the tram of the Socorro M. & M. Co. Counter-balanced skips will be used. The capacity per 8 hours is 75 tons. Ores mined by this company from Maud S, Deep Down, Eberle, and Clifton mines will be carried by this tramway. In the meantime burros will continue to be used for moving ore.

OKLAHOMA

Douthat.—The Quebec mine here is turning out the best concentrate known in this district. Five carloads recently assayed 64.8, 64.9, 64.9, 65.0, and 65.7% zinc. The product contains no lime or iron, and only a trace of lead. The ore, mined at a depth of 155 ft., yields from 11 to 22% blende. E. R. McClelland is owner, and T. Skelton is manager.

UTAH

Marysvale.—The Liberty Manganese Co. has received settlement for 35 tons of 45.99% manganese ore recently sold.

Park City.—The Judge M. & S. Co.'s enlarged plant will be ready early in December. Its capacity will then be 30 tons of electrolytic spelter daily. The present product assays 99.924% zinc, 0.049% lead, 0.024% cadmium, and 0.003% iron.

Tintic.—Manganese ores occur in several places in the area that extends from Utah lake south-westward 75 miles or more and that embraces parts of Utah, Tooele, and Juab counties. Most of the work has been done in the central part of this area, in the Tintic and West Tintic or Erickson mining districts. The deposits elsewhere are reported to be wholly undeveloped or opened only by shallow workings. A reconnaissance of the Tintic and West Tintic (Erickson) districts, including the examination of four or five partly-developed mines, was made by J. T. Pardee, of the U. S. Geological Survey, in June 1918.

Several manganese deposits are partly explored by workings made during the last 40 years in search of silver and lead ores. Small quantities of manganese ores and manganiferous-iron ores have annually been produced in the Tintic region for use as flux at lead and silver smelters. Among the older mines in which manganese ore has been explored are the Tip Top tunnel, at Homansville, and the Black Jack group, in the West Tintic district. Both are now producing high-grade manganese ore. Other mines in which considerable bodies of manganese ore are found are the Baby Elephant group, Queen Mary, Indian Boy, May Farmer, and Eutonia. Undeveloped outcrops of manganiferous material similar to that composing outcrops of developed orebodies are numerous. The exploration of the lodes for manganese ores began only last October at the Tip Top tunnel, and even more recently in the other parts of the general area here considered. Up to the end of June 1918, 1400 tons of manganese ore had been shipped. Most of this contained from 37 to 40% Mn and from 8 to 12% silica. The ore contains only 1 to 3% of iron, but that from the Tip Top tunnel is rather high in phosphorus, some shipments having contained nearly one-half of 1%. The latest shipments from this deposit, however, show only one-fourth of 1% of phosphorus, and those from the West Tintic district show less than 1/20 of 1%.

Two mines, the Tip Top tunnel and a mine working on the Black Jack group, are now producing altogether about 450 tons per month. Production in the West Tintic district could be increased to 500 tons monthly, and probably to

several times that quantity if reasonably cheap transportation to the railroad could be had. Ore is now being hauled 28 miles by team from the Black Jack mine to Luceme, on a branch of the Salt Lake Route, at a cost of $8.75 per short ton. Ore from other deposits near by would have to be hauled 1 to 5 miles farther, and few of them are reached by good roads. It is said that the railroad company and others are considering a plan to build a branch line from the Salt Lake Route north-westward through the West Tintic district.

Ores of different grades are more or less intimately mixed in most of the deposits, and it is uncertain whether the grades can be readily separated either by selective mining or by some easy method of concentration. Estimates based in part upon examinations made by Mr. Pardee and in part on reports that are believed to be trustworthy, indicate that there is available more than 500 tons of ore carrying more than 40% Mn, and between 8 and 12% silica; and probably more than 3000 tons of ore of this grade. The reserve of ore carrying 25 to 40% Mn and high silica probably will exceed 10,000 tons.

Practically all the mining has been done by lessees who pay the owners royalties of 10% on the net returns at one mine and $2.50 per ton at another. Wages are $4.75 to $5 per day, and labor for the smaller mines has not been difficult to obtain.

The orebodies in general form irregular branching 'pods', lenses, or pipes, which lie along the upper parts of jaspery-quartz lodes in limestone, quartzite, or shale. Most of them extend nearly to the surface and the lower limit of two or three of them is about 100 ft. The largest bodies yet developed are at least 100 ft. long and 15 to 20 ft. diameter in their widest parts. The orebody at the Tip Top has yielded about 27,000 cu. ft. of manganiferous material, and is not yet exhausted. About two-thirds of this material, equivalent to 1200 tons, was selected in mining as high-grade ore. At two mines, the Baby Elephant No. 1 and the Eutonia, the water-level, which is 100 ft. below the surface, marks a rather abrupt change from manganese oxides above to rhodonite below. The workings at the other mines have not penetrated below the oxidized zone.

The ore is a mixture of manganese oxides, chiefly pyrolusite and wad. Although most of it is soft and crumbly, it includes considerable quantities of rather tough and compact wad. Ores of different grades are intermixed in most of the deposits, and it is a question whether the grades can be readily separated by selective mining or easy methods of concentration. Jaspery-quartz is more or less intimately mixed with the ore, and streaks of a soft gray or yellow clay, apparently a decomposition product of the wall-rock, are common. The lodes in which the manganiferous bodies occur are persistent and are apparently of deep-seated origin, and all of these contain more or less silver and lead.

Wendover.—The Silver Queen Leasing Co., operating 30 miles from this place on the Western Pacific, has sent a carload of fluorspar to the Pacific Coast. This is said to be the first fluorspar sent out of Utah. The 20 tons sold realized $31.17 per ton. Eureka and Provo people are largely interested, A. R. Sorensen of the former place being one of them.

KOREA

Unsan.—Oriental Consolidated produced gold worth $95,500 during September. In August, the plants treated 21,842 tons, which yielded $93,470. The rainfall in August was 22¼ in., and the Shorrie reservoir was filled. Okura & Co., who supplied some power to Oriental Consolidated, stopped their plant and went out of business on October 31. The mining company must therefore use wood for steaming until its hydro-electric power-plant is finished.

PERU

La Fundicion.—Cerro de Pasco produced 6,150,000 lb. of copper in September, equal to June last.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Courtenay De Kalb is at Washington.

Carl Andersen has gone to Goodsprings, Nevada.

William Frazer has returned from California to Butte.

Franklin W. Smith has returned to Bisbee from Parral, Mexico.

J. B. Tyrrell has been examining chrome mines at Black Lake, Quebec.

F. W. Bradley is expected in San Francisco on his return from Juneau, Alaska.

Frederick G. Lasier, of Detroit, now Captain in the Engineer Corps, is at Camp Humphreys.

Ernest B. Lighthill (formerly Lichtenberg) has been commissioned a Major in the British Army.

R. R. Leslie is general superintendent for the Cubo Mining & Milling Co. at Guanajuato, Mexico.

W. Spencer Hutchinson has returned to Boston after examining mines at Cripple Creek, Colorado.

Stanley C. Sears, of Salt Lake City, Captain in the Engineer Corps, is at Camp Humphreys, Virginia.

Arthur J. Bensusan, superintendent of the Ouro Preto mines, in Brazil, is here on his way to Arizona.

J. F. Thorn and **David Pullinger**, of the Butters Salvador Mines, have arrived in San Francisco from Salvador.

D. H. Harroun, manager for the Aguascalientes Metal Co., at Acientos, Mexico, has arrived in San Francisco.

T. E. Mitchell, who has resigned the position of manager of the Burma Mines Ltd., is in San Francisco on his way to London.

James M. Mercer, recently engaged in the management of American wolfram properties in Bolivia, has been transferred to Chile.

Frank H. Sistermand, of New York, will leave for Costa Rica to take charge of the operations of the Nicoya Mining Co., at San Jose.

Robert E. Cranston, of San Francisco, has joined the Food Administration and will not be open for engagements during the period of the War.

E. V. Daveler has resigned as assistant manager for the Alaska Gastineau Mining Co. to become mill superintendent for the Butte & Superior Mining Co. at Butte, Montana.

Anthony Jenkin has resigned as mining engineer to the Seneca Mining Co., Calumet, Michigan, and has joined the staff of the Utah Consolidated Mining Co., Bingham, Utah.

Harry H. Stout, to whom is credited recent important improvements in the smelter practice of the Copper Queen Consolidated, is now Lieutenant-Colonel in the Ordnance Department of the U. S. Army.

Henry Krumb, consulting engineer of Salt Lake City, has been in Washington for several months, having been appointed a member of the Priorities Committee of the War Industries Board. Mr. Krumb will handle all applications for priority certificates relating to the equipment and supplies for copper and other non-ferrous mines and smelters.

W. A. B. Walling died from pneumonia, after influenza, on October 20 in New York at the early age of 29. An Englishman, he received his technical training at the Battersea Polytechnic, London, and had been a member of the Minerals Separation Co.'s staff for 10 years. Although young, he was widely known and respected, both in this country and in England, for his technical ability and personal qualities, and his untimely death, which cuts short a promising career, will be regretted by many friends and acquaintances.

THE METAL MARKET

METAL PRICES

San Francisco, October 29

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11.50
Zinc-dust, cents per pound	15

ORE PRICES

October 29

Chrome, no definite quotations available.	
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% Mo_2S	$1.25
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$26

EASTERN METAL MARKET

(By wire from New York)

October 29.—Copper prices will remain unchanged until January 1. Lead is stationary. Spelter is quiet and easier.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

Date	New York,	London,	Average week ending	
Oct. 23	101.12	48.81	Sept. 17	101.12
" 24	101.12	48.81	" 24	101.12
" 25	101.12	48.81	Oct. 1	101.12
" 26	101.12	48.81	" 8	101.12
" 27 Sunday			" 15	101.12
" 28	101.12	48.81	" 22	101.12
" 29	101.12	48.81	" 29	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	....
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, prices to be effective on the day of shipment, not the day of sale.

Quotations in cents per pound are as under:

Date		Average week ending	
Oct. 23	26.00	Sept. 17	26.00
" 24	26.00	" 24	26.00
" 25	26.00	Oct. 1	26.00
" 26	26.00	" 8	26.00
" 27 Sunday		" 15	26.00
" 28	26.00	" 22	26.00
" 29	26.00	" 29	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	....
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Oct. 23	9.15	Sept. 17	9.62
" 24	9.10	" 24	9.76
" 25	9.05	Oct. 1	9.55
" 26	9.00	" 8	9.31
" 27 Sunday		" 15	9.02
" 28	9.00	" 22	9.08
" 29	8.95	" 29	9.04

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.50
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	....
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
Oct. 23	8.05	Sept. 17	8.05
" 24	8.05	" 24	8.05
" 25	8.05	Oct. 1	8.05
" 26	8.05	" 8	8.05
" 27 Sunday		" 15	8.05
" 28	8.05	" 22	8.05
" 29	8.05	" 29	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	....
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefor $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
Oct. 1	120.00	Oct. 15	120.00
" 8	120.00	" 22	120.00
		" 29	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	....
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	....
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

ALUMINUM

For 50-ton lots of No. 1 virgin metal, 98 to 99% pure, or of scrap, the fixed Government maximum price is 33c. per lb., with 33.10c. per lb. the level for 15 to 50-ton lots and 33.20c. per lb. for 1 to 15-ton lots.

ANTIMONY

The market is stagnant and is again lower at about 13.37½c., New York, duty paid, for wholesale lots for prompt and early delivery.

ORES

Antimony: There have been no developments.

Ferro-silicon: At a meeting of the domestic makers of 50% alloy, except the largest, last week, it is said that the following quotations were agreed upon: $152.50 per ton for delivery in all of 1919, $155 for delivery in the first half, and $157.50 for delivery in the first quarter. The alloy can be bought, however, for $150 for any delivery in 1919.

Manganese alloys: The market is easier, if anything, for both ferro-manganese and spiegeleisen. It is said that the present quotation of $250, delivered, for 70% alloy, plus or minus $3.50 per unit, could be decidedly shaded on an attractive offer. Spiegeleisen, 16% has sold at $70, furnace, against $75 ruling some time ago.

Molybdenite: Inquiries are reported, but no business, with quotations unchanged at $1 to $1.25 per lb. of MoS_2 in 90% concentrate.

Tungsten: The effect of peace on prices and the future of the market is being discussed anxiously. Thus far the market has remained fairly firm with high-grade ore sold at $26 per unit in 60% concentrate. High-grade ores range from $24 to $26 per unit with low-grade ores running from $19 to $24.

Eastern Metal Market

New York, October 24.

All the markets continue quiet with peace talk having very little visible effect.

The copper price to rule after November 1 will be decided Friday of this week, October 25. No change is expected.

The tin market is stagnant with Government control virtually in force, but no price fixed yet.

The lead situation is unchanged, but is satisfactorily controlled.

Zinc has continued stronger, but business has been light.

Antimony is lifeless and a little lower.

The influenza epidemic is quite extensively interfering with the output of iron and steel plants, particularly in eastern Pennsylvania and in the Pittsburgh district. In the case of the Carnegie Steel Co. 10% of the labor force is affected against 7% a week ago. The United States Steel Corporation has resorted to a wholesale serum inoculation. Peace talk has caused a widespread canvass of factors in the coming readjustment, but it has not abated in the least the pressure for the fullest production. Some form of Government control is recognized as necessary in the transition. A feature of the past two weeks has been the inquiry for special steels. At Pittsburgh 1500 tons of vanadium spring-steel and 2000 tons of chrome-silicon-manganese steel for tractors and tanks for France are soon to be closed. About 137,000 tons of barbed wire has been distributed to the Allies, 65,000 tons to Italy, 50,000 tons to France, and 22,000 tons to Great Britain.

COPPER

The price that is to control the copper market for a period after November 1 will be decided on October 25. Very few expect any change in the present 26c. level. As to what will be the market-level after the lid is lifted and all restrictions removed, there is a wide diversity of opinion. One large copper-dealer expressed the opinion today to your correspondent that he did not look for an advance over the 26c. level when more normal times come; he called to mind the fact that before the War the price was about 12c. per lb. and that even under present abnormal conditions there are several companies producing at a cost of only about 20c. Such companies in a free market, he thought, would surely see to it that all high-cost producers are shut out; he did not look for a higher price than 20c. under more normal conditions, especially in view of the greatly increased output of the war period. Influenza and the effects of the munitions explosions near the large refineries in New Jersey are said to have cut down the output of refined copper so that the October production will be less than in September. Some of the employees have not returned to the refineries since the scare as a result of the explosions. An interesting fact is gleaned from the export and import statistics for August, recently made public: the importations that month were 32,000 gross tons, the largest for the year, while the exports were only 18,889 tons, or the lowest for the year thus far. These facts are cited as an argument for larger supplies.

TIN

The fact that market news comes to your correspondent only through actual contact with importers or dealers and not through the public press has, in the case of the tin market, worked to some disadvantage. It has been published from Washington that various new regulations were to go into effect, or already have, but none of this has come directly from an importer. It seems that these men have been practically ignored and that they have been virtually put out of business for the period of the War. They do not know this officially yet at least, but they now acknowledge it as a probability. It is apparent that only the U. S. Steel Products Co. is to be granted any import licenses and that this agent will turn over all metal to the American Iron and Steel Institute for distribution to consumers who are entitled to it. Full details are expected soon, as Mr. Hughes will probably reach this country most any day. A meeting of importers was held in New York last week and another yesterday. It is not unlikely that a Tin Importers Association will be formed to look after the interests of the trade, particularly under present price conditions.

In general the market is lifeless. There have been a few offerings of metal in transit and for spot delivery by those desiring to get rid of the stock before a price is fixed, but demand is very light. Some sales have been made at about 77 to 78c. per lb., New York, for such delivery; but this is a nominal quotation. For the first time certain applications for licenses for shipment of tin in November have been refused; this means that importers from the other side cannot ship metal, but it is felt that some arrangement will be reached whereby importers here will be able to fill any contracts they may have. Evidently Government control of some kind is near at hand, but no price has yet been fixed. Pacific Coast arrivals for the month to October 17 have been 2325 tons, with 425 tons received at Atlantic ports. The London market is again lower with spot Straits quoted yesterday at £334 per ton, or £2 10s. lower than a week ago.

LEAD

The situation is so absolutely in the hands of the Lead Producers' Committee that there is very little to be said. Entire satisfaction prevails and conditions are easier, if anything, due to the good judgment exercised. No domestic lead is being exported, it is stated, and only those doing essential work are apportioned any metal. Prices remain fixed by agreement at 7.75c., St. Louis, or 8.05c., New York. The effect of the conservation of supply is reported as quite evident.

ZINC

The advance that was reported as in progress a week ago has continued until now, so that the quotation yesterday was about 8.85c., St. Louis, or 9.20c., New York, for prime Western for early delivery. Owing to the very light demand this is largely nominal, though 8.90c., St. Louis, is said to have been done in a small way. It is believed by some that the peak of this movement has been reached. Peace talk has scared some sellers, reminding them of the low prices before the War, but it is felt by others that it will be a long time before anywhere near such prices will be experienced again, even after peace comes. The Government inquiries for 9000 tons, noted a week ago, are the principal cause of the firmer market, but it is not known how much of this tonnage has been actually taken, though some of it has been contracted for at around 8.50c., St. Louis, it is believed. November shipments of prime Western have been offered at about 8.60c., St. Louis, with December quoted at 8.50c. There have been bids for first quarter of 1919 at 8c., St. Louis, with a few offers at 8.12½c. The weekly Government report shows a slight increase in output of all grades for the week ended October 12, with a decrease in stocks of over 3000 tons, rendering the statistical position strong.

Mining Decisions

Mining Partners—Fraud in Re-locating

When plaintiff and defendant were equal partners in a mining claim, and defendant promised to have the assessment work done, but did not, and with intent to defraud plaintiff procured another person to re-locate the claim and subsequently sell it, plaintiff was entitled to half the proceeds of the sale.

Kittilsby v. Vevelstad (Washington), 173 Pacific, 744. July 10, 1918.

Mining Deed—Description Construed

A mining company made a mortgage deed specifically describing 2100 feet of its lode and "also all the real estate of said corporation acquired and which may be acquired in Summit county, Colorado, whether the same is particularly described herein or otherwise." Held, that this deed conveyed title to the entire lode and was not limited to 2100 feet thereon.

Sutton, Steele, etc. Mining Co. v. McCullough (California), 174 Pacific, 302. July 1, 1918.

Oil Lands—Cancellation of Patent Refused

In a suit to cancel a patent to public lands issued to the Southern Pacific Company on an affidavit of its land agent that the lands were not of a mineral character, where no mineral development or geological studies warranted an inference at the time the affidavit was made that the lands were in fact valuable for oil, the patent cannot subsequently be set aside because the lands were afterward discovered to be in an oil-belt.

Southern Pacific Co. v. United States (California), 249 Federal, 785. May 6, 1918.

Oil Placers—Group Discovery Work

Drilling on one oil-placer location by a locator to whom various adjoining claims have been assigned by their locators subsequent to the filing of location notices, cannot be accepted as work leading to a discovery on all the locations, so as to bring them all within the provisions of the Picket Act protecting bona-fide locators; it being obvious that whether or not any discovery work would be subsequently carried on such adjoining locations would depend on the result obtained from the drilling done by a party not a locator of these claims on a claim which was not one of an original group.

United States v. Honolulu Consolidated Oil Co. (California), 249 Federal, 167.

Adverse Possession—Presumptions Arising From

In suits to quiet title based on adverse claims to patent, instructions to the jury on the question of presumptions arising from adverse possession for the prescriptive period of time, were improperly refused by the court where the testimony clearly showed that open and exclusive possession had been in defendant or his predecessors in interest for several years, that the annual assessment work had been done, and much additional expenditure for works and buildings made. The jury were entitled to consider this evidence in connection with that of the original discovery made by locators long since dead in order to give the party in possession who was spending time, money, and labor in development, the benefit of all presumptions in favor of an original discovery of mineral in paying quantities.

Ralph v. Cole (Nevada), 249 Federal, 81. May 13, 1918.

Mineral Character—Land Department Finding Conclusive

The United States government may, by a direct suit against a mining locator, test the sufficiency of his discovery to support his location of public lands under the mineral laws; and in such a proceeding, the determination by the Secretary of the Interior that the land is in fact non-mineral is conclusive evidence of its non-mineral character, and hence conclusively establishes that no discovery was in fact made. Evidence to the contrary will not be admitted by the court. The Land Department has the power to set aside a mining location and restore the ground to the public domain where the location is not perfected.

Cameron v. United States (Arizona), 250 Federal, 943. May 6, 1918.

Note: The above case disposes of the contentions of one of the persons seeking to control access to the rim of the Grand Canyon of the Colorado through the medium of a mining location.

Company Reports

NORTH BROKEN HILL, LIMITED

Property: mine and works at Broken Hill, New South Wales, Australia.

Operating Official: George Weir, general manager.

Financial Statement: during the half-year ended June 30, 1918, products realized £329,344 ($1,580,000). Operating costs were 24s.8d. ($5.92) per ton. The profit was £167,415 ($801,600). After paying dividends the balance forward was £60,236 ($288,000). Assets were £599,851 ($2,875,000) in excess of liabilities, mostly cash items.

Dividends: two, No. 47 and 48, of £60,000 ($288,000) each were paid.

Development: the main shaft is 1770 ft. deep. Four levels—950, 1100, 1250, and 1400 ft.—yielded 106,489 tons of ore.

Production: the mill dressed 109,200 tons, assaying 15.3% lead, 7.5 oz. silver, and 12.4% zinc. This yielded 20,605 tons of concentrate, containing 65.2%, 24.1 oz., and 7.7%, respectively. Recoveries were 80.3% lead and 61% silver. The zincy tailing was delivered to the Amalgamated Zinc (De Bavay's) for treatment by flotation, which would add to the above recoveries. The metal contents of the ore were 16,713 tons of lead, 14,583 tons of zinc, and 813,467 oz. of silver.

GREAT BOULDER PROPRIETARY GOLD MINES, LTD.

Property: mines and mill at Kalgoorlie, Western Australia, having produced £11,171,490 ($52,900,000) since 1895.

Operating Official: Richard Hamilton, general manager.

Financial Statement: revenue from gold in 1917 was £529,718 ($2,544,000), of which £253,026 ($1,200,000) was profit. After paying dividends, etc., the balance to 1918 was $2839 ($13,500). Cash, bullion, and supplies, etc., total £233,000 ($1,118,000).

Dividends: four of 9d. (18 cents) each totaled £262,500 ($1,258,000). A similar sum has been paid for 13 years, and the total since 1895 is 3082% on the capital.

Development: only 553 ft. of new openings were made last year, making 22 miles in all; also 1167 ft. of diamond-drilling, making 10.62 miles. Reserves to 2500 ft. in the main shaft are 333,721 long tons averaging $14.98 per ton, to 500 ft. in Lane shaft 15,156 tons of $10.45 ore, and to 1650 ft. in Hamilton shaft 38,634 tons of $11.30 ore, making a total of 387,511 tons, averaging $14.44 per ton.

Production: the ball-mills, roasting-furnaces, grinding-pans, and cyanide plant treated 182,265 tons, yielding 150,030 oz. of gold-silver bullion. Extraction was 90.22%.

Costs: these were $6.16 per short ton in 1917, $5.96 in 1916, $5.70 in 1915, and $5.66 in 1914.

Mining and Scientific Press

Edited by T. A. RICKARD

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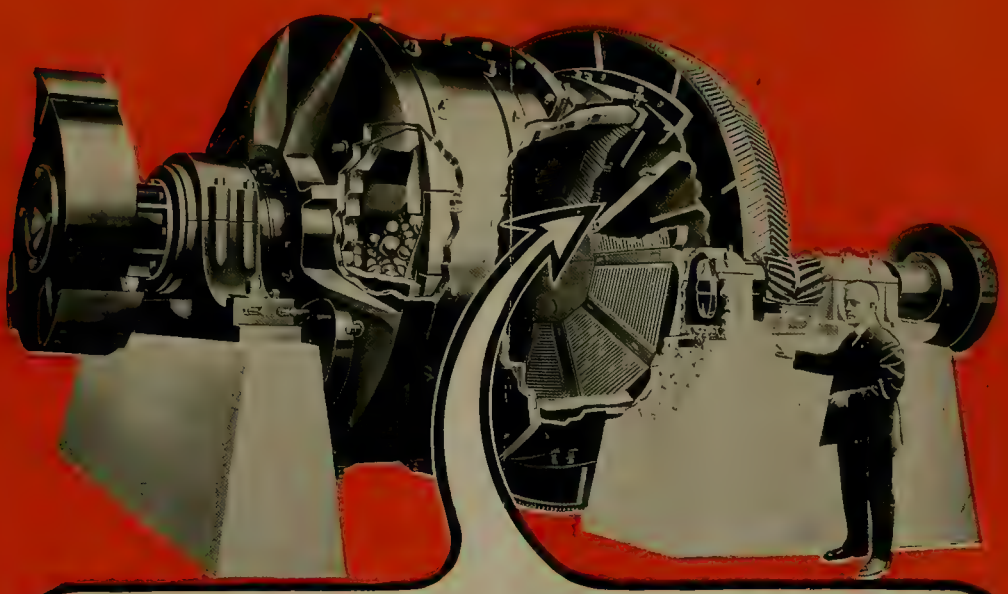

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T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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THE Kaiser in his letter of October 28 to the Chancellor makes mention of his "exalted allies." The letter was published a week later, on the very day Austria capitulated and four days after Turkey had surrendered. Fate deletes "exalted" and substitutes 'abased'.

OVER-SUBSCRIPTION of the Fourth Liberty Loan by $866,416,300 more than the six billions required bears splendid testimony to the willingness of the American people to back the Government in the great work now coming to fruition. Before the War the raising of the surplusage would have been considered an achievement.

IT gives us keen pleasure to state that Mr. Horace V. Winchell has been nominated President of the American Institute of Mining Engineers for the coming year. By reason of his personality and experience he will prove admirably adapted to the duties of the office; in consequence of the public spirit he has shown and the professional distinction he has achieved, he is well worthy of the honor.

ON another page we publish a useful article on the smelting of silver precipitate from a cyanide plant in an oil-burning reverberatory furnace at Guanajuato, Mexico. The article is written by Mr. K. A. Cunningham, now general manager for the Mexican companies controlled by the Guanajuato Development Company, and Mr. Arthur Feust, until recently resident consulting engineer in Mexico for the same company.

DEALINGS in mining shares in London have been upset by the epidemic of Spanish influenza, according to the 'Financial Times.' From Ashanti to Johannesburg the working forces in the mines have been hit hard by this infliction. At the Prestea mine three-fifths of the natives are reported on the sick-list, while on the Rand the Kaffirs have gone down like ninepins to the pestilent germ. Incidentally, we may mention that a week ago more than half our own office-force was laid up, but, fortunately in no case did a fatal result ensue.

SECRETARY McADOO, it is announced, has nominated a committee to investigate the difficulties hindering the production of gold and to devise some plan of affording relief. This committee consists of Messrs. Raymond T. Baker, the Director of the Mint, Edwin F. Gay, representing the War Trade Board, Emmet D. Boyle, Governor of Nevada, Pope Yeatman, representing the War Industries Board, and Albert Strauss. It is five months since Mr. McAdoo stated that the production of gold ranked in importance next to that of food and ammunition, therefore it should not seem discourteous to suggest that this appointment of a committee is a belated recognition of an important industrial problem and that the least the committee can do is to expedite its investigations so that any proposal resulting therefrom may be put into effect without delay.

IN the 'Mining Magazine' for September there appears an excellent article by Mr. E. Mackay Heriot, on 'Mining in Spain,' in the course of which he refers to the platinum deposits of that country. It appears that a Spanish geologist, Don Domingo Orueta, has detected platinum in the dunite rocks of the Ronda mountains. This fact is interesting to miners in California because similar basic rocks are to be found in this State, although they are difficult to recognize on account of being readily altered to serpentine. In the Ural region, which is the chief source of the world's supply of platinum, this metal is derived from peridotite, of which dunite is the basic and norite the acid phase. Although platinum is mined wholly from the debris of such rocks, in the form of alluvium, it is important to trace its source in order to ascertain the localities likely to furnish profitable placer deposits.

'IMPERIAL' has become a word taboo in the lexicon of modern democracy. The governments of Germany and Austria-Hungary have been wise to the logic of events and no longer use this adjective. There is a decided slump in kings and emperors; they are going into a discard prepared for them by centuries of misrule and suffering. Even our friends the British are beginning to speak of the Commonwealth in preference to the Empire, and the day is at hand when realities will be recognized and their king will be called, as he is in fact already, a hereditary president—a term, by the way, misused ludicrously by William II of the Hohenzollern dynasty when he suggests that he might be thus designated by the people whom he has led to disaster. In time the hereditary idea in government, as in legislation, will

be recognized to be a belated anachronism, together with primogeniture and other fallacies inherited from the dead formulas of feudalism.

SATISFACTORY as it may be that the German grip on the New York metal market has been broken by that excellent official, the Alien Property Custodian, Mr. A. Mitchell Palmer, it will not be an unalloyed benefit to the mining industry if the control of our principal metal market slips into the hands of any other cartel of speculators. Henry R. Merton & Co., the British representative of the Frankfort Metallgesellschaft, has been liquidated and the American Metal Company of New York will shortly be dissolved. So far, so good; but, owing to Government control of the business, all American copper is now being exported through the American Smelting & Refining Company, the domestic field being left to the United Metals Selling Company. We hope the time may come when it will be considered improper for smelting companies to act as metal-brokers and that an even more auspicious day may supervene when the market for copper and lead, for example, will not be in the hands of any smelting company or any group of buyers.

WE have received a copy of the brief filed by Minerals Separation in support of its petition to the U. S. Supreme Court for a writ of certiorari, and of the opposing brief filed by the Butte & Superior Mining Company. The petitioners assert that the two questions involved are (1) whether the Court by its decision in the Hyde case confined the patent in suit and all its valid claims to the use of half of 1% of oil as the upper limit of the invention, and (2) whether the Court by its decision in that case extended the patent to include the use of any and every oil having a preferential affinity for metalliferous matter over gangue, regardless of the function and operation of such oil and regardless of the results obtained. On the other side, the respondent (1) asserts that if the writ be issued, it will bring up for determination only one question, to wit: whether the patent covers the use of oil in quantities between one-half of 1% and 1%, and (2) denies the relevancy of the question whether oils inert in the process are to be taken into account in determining infringement. Moreover, the respondent asserts that there is no conflict of decisions, and that the case does not present any novel question of law.

"THE whirligig of time brings in his revenges." Little Serbia, bullied by Austria and then attacked at short notice under pretext of complicity in the assassination of the Archduke Franz Ferdinand at Serajevo, in Bosnia, on June 28, 1914, is about to be restored and to become the nucleus of a greater Serbia, which is to include Bosnia, Herzegovina, and, we hope, Albania, Montenegro, Croatia, and Dalmatia. On October 31 the kingdom of Greater Serbia was proclaimed at Serajevo and on the same day the surviving assassins of the Archduke were released from prison. Gavrilo Prinzip, the man that fired the fatal shot, died in prison a few months ago; he was an Austrian subject of Serbian race, and the assassination furnished no valid reason for Austria's brutal onslaught on Serbia. We know now that even as an excuse it was false, for the plan to attack Serbia and embroil Russia had been made by the two criminal governments of Germany and Austria two years before, according to the revelations made by Herr August Thyssen. Another of Time's revenges was the meeting between the British commander, Admiral Calthorp, and the Turkish plenipotentiaries at Mudros, on the island of Lemnos, on October 30, when the Turkish forces capitulated. It was at the port of Mudros that the British established their military and naval base at the time of the Gallipoli campaign in 1915. Mudros has a natural harbor ringed with hills "like a great extinct crater flooded by the sea," as John Masefield has described it. Before the War the town consisted of a few miserable shanties inhabited by Levantines, but on April 23, 1915, it saw a great fleet of transports crowded with soldiers about to start on a splendid adventure. "No such gathering of fine ships has ever been seen upon this earth, and the beauty and exaltation of the youth upon them made them like sacred things as they moved away." So wrote the poet. They failed gloriously and from their gallant effort came in due time the meeting between the British admiral and the Turkish bearers of the white flag.

CIRCULARS have been issued from Washington notifying those whom it may concern that Mr. Van H. Manning, as Certifying Advisor for the metal-mining and metallurgical industries (excluding iron and steel) has announced the organization of district representatives to take charge of the furloughing of men indispensable to the industries and already enlisted in the Army. Mr. Manning urges officials of companies to confer with the nearest District Certifying Officer in order that they regain the services of men essential to the production of war material, such as metals. Of course, should the War end shortly by the capitulation of the German armies, as is possible, it will be highly desirable to expedite the return to their normal occupation of all the technical men not already overseas. The District Certifying Advisors appointed are as follows: For the State of Washington, Conrad Wolfle, 217 Symons building, Spokane; for Oregon, Harold N. Lawrie, Oregon building, Portland; for California, Edwin Higgins, care of California Metal Producers Association, San Francisco; for Idaho, Frederick Burbidge, Wallace; for Montana, John Gillie, Butte; for Utah, Walter Fitch, 304 Boston building, Salt Lake City; for Nevada, Walter S. Palmer, University of Nevada, Reno; for Arizona, L. D. Ricketts, Warren; for New Mexico and western Texas, John M. Sully, Santa Rita; for South Dakota, W. J. Sharwood, Lead; for the Missouri, Kansas, Oklahoma zinc district, Percy B. Butler, Joplin; for the south-east Missouri lead and Kentucky fluorspar district, H. A. Buehler, Rolla; for the Wisconsin lead and zinc district, W. O. Hotchkiss, Madison; for the Michigan, Wisconsin, and Minnesota iron ranges,

George H. Crosby, Duluth; for the Michigan copper range, Frederick I. Cairns, Houghton.

Victory

During recent days the march of events has been so rapid as to leave us breathless and almost stunned by the weight of their significance. The absence of overt excitement has been remarkable; a visitor from abroad, say, Macaulay's apocryphal New Zealander, might easily have concluded that we were stolid to the point of stupidity. It may be that the prevailing epidemic of influenza has been partly responsible in so far as the compulsory wearing of gauze masks has checked conversation and hindered the recognition of acquaintances, while public ordinances have placed a ban on the assembling of groups or crowds inclined to celebrate the joyous news that has tumbled upon us from hour to hour; it may be that the long-drawn anxiety, particularly of the last seven months and the repeated shocks to our intelligence given by the bawling and often grossly misleading headlines of the daily press have deadened our sensibility to impressions. Whatever the causes, it is astonishing how quietly this community has received the news of events that will affect human affairs for centuries to come. As a soldier said to his comrade in the trenches: "Say, Bill, this is a great War: it is almost like one of those wars in history!" The long and short of it is that the Enemy is beaten irretrievably and the world has been saved from the jungle code of militarist savagery. The paranoiac dream of the German Headquarters Staff have been shattered, the Berlin to Bagdad ambition has dwindled to a Berlin to Bodenbach reality, the insolent propaganda of Kultur has been stultified for all time, the pentecost of calamity is near an end, the dawn of a new and more orderly world is breaking on the horizon. Our gladness is beyond shouting, our thankfulness exceeds the limits of speech. The people of America are taking these tremendous events soberly because, among other reasons, the more thoughtful of them realize that there is much yet to be done. The world has been liberated from Prussianism, but Europe is in danger of Bolshevism. As was foreseen by many careful observers, the destruction of the morale of the Central European armies is giving opportunity to the unbridled spirit of anarchy. From the capitals of the defeated powers, from Sofia, Constantinople, Vienna, Budapest, and Berlin there come stories of revolt and disorder; kings and emperors are being thrown into the discard; with them for a time is going constituted authority, and in their wake follow wild outbreaks of protest against the repression, suffering, and famine that dog the heels of unsuccessful warfare. At the time of this writing the government of Germany is still in the saddle, because the German armies are not as yet disintegrated, but it appears likely that, if an orderly capitulation is not effected, the principal Enemy may go the way of his dupes and vassals, to be overwhelmed in a whirlwind of long repressed popular revulsion against the unendurable horrors of war. For this sequel to his defeat we do not hope. The task that the Allies have in hand, in re-making the map of Europe to accord with national determinations and in measuring justice to the chief criminals at Berlin and Vienna, is big enough, in all conscience, without imposing upon them the further labor of managing the disorderly mobs that threaten to assert themselves on the ruins of Kaiserism. For that reason we hope that Germany will accept the terms of the armistice, not yet announced, because, if a moment of passionate insurgence should prompt the cry for a last desperate struggle by the German armies, the result of further fighting would be such punishment as to destroy their discipline and to sweep aside all remnants of government in a disorderly stream of armed men, reckless and desperate, as happened after the Russian debacle. Prussianism and Bolshevism are complementary; in ridding the world of one we have to face the need for curbing the other. The next few months are destined to be as memorable as those that have just preceded them, for the Allies now face the honorable and arduous task of reaping the fruits of victory by decisions so just as to ensure the restoration of civilization in Europe, and upon them also devolves the beneficent duty of bringing food and clothing to the victims of the great contest, even to those in the enemy countries. To this task, as to the fighting, the United States, we do not doubt, will devote herself with an idealism that has already gone far to prove how the American people can industrialize their lives without commercializing their souls.

Chromite

On October 31, Mr. Albert Burch, representing the War Industries Board in California, received the following telegram from Mr. Hugh W. Sanford, chief of the Chemicals Division of the Ferro-Alloys Section of the War Industries Board. "Referring my telegram September 27, which you had published. This seems to have caused misconception in minds of some chromite purchasers who have interpreted this telegram to mean that the Government was guaranteeing not only full consumption of chromite for balance of this year and first half of next year, but also that the guarantee was for sales during either or both periods at the price prevailing during the summer of 1918. This interpretation cannot properly be gotten from the language of the telegram. In order to clear up any misconception please have this complete telegram published. The War Industries Board does not at this time guarantee any sales of chromite for balance of this year or the first half 1919 at any prices. The War Industries Board has asked chromite users to buy as much domestic chromite as possible during the remainder of this year and may decide to request buyers to purchase domestic chromite for the first half of 1919 on some new price basis. It is impossible to say how fully the buyers will co-operate with such requests. Stocks in hands of users are large, particularly stocks in hands of users of high-grade ores. These stocks probably average ten or twelve months' supply. The over-supply of chromite today is due more

to decreased domestic consumption than to any other one factor. The domestic consumption being about 35,000 tons less than anticipated for 1918. This is due chiefly to the recent changes that have been made in the industries for the necessities of the war program, such as reduction in manufacture of automobiles, which industry formerly absorbed large quantities of ferro-chrome and also the use of less chrome tanning in the leather trade on account of vegetable tanned shoes being used largely in the Army for trench-work. A program has been recommended to the War Trades Board by the War Industries Board for a reduction of imports from all countries to the lowest practical minimum and their decision will probably be announced in a few days. The War Industries Board has also removed all restrictions on conservation of use of chromite and is not denying proper exports of chrome products. Serious consideration is being given by all governmental departments to this problem, but at present it is doubtful whether additional aid can be given to the domestic chromite situation beyond the procedure stated above. If any further developments will advise you." We give prominence to this telegram, unsatisfactory as it is, because we know the keen interest in the subject felt by many of our readers, particularly in California.

Freedom of the Seas

Before the rulers of Germany committed the greatest crime recorded in history the German mercantile marine sailed the seven seas and transacted a worldwide business, thanks to the 'freedom' whereby coaling-stations, harbors, and markets were placed at their disposal, as they were open to all others, particularly wherever the British and American flags floated. The mad attempt to win dominion caused these gateways and highways of the ocean to be closed to them. Now they whine about this loss of 'freedom' on the sea and demand the right to go where they will. What they would have done if they had vanquished the British navy, we can guess, having seen what their notion of 'freedom' meant to hapless neutrals on land. From that nightmare of savagery we have been saved, thanks to the descendants of Drake, Rodney, and Nelson, as also to those of Paul Jones and Farragut. During the four years of warfare Germany has lost half her mercantile marine, and if the vessels interned in neutral ports be held as indemnity for her pirate doings she will be left with only one-third her former shipping. While war has raged, however, she has made a tremendous effort to construct new ships, the total tonnage amounting to 850,000 tons, equal to about a quarter of her losses. In cynical disregard of foreign sentiment one new Hamburg-American liner is called the 'Tirpitz' and a new North-German Lloyd liner is named the 'Zeppelin,' leaving us to imagine how many travelers outside Central Europe will care to take passage on vessels so named. They may have been christened when the phrase 'freedom of the seas' meant to the Germans the exclusion from the ocean thoroughfares of any but their own ships, but by this time the shipowners of Hamburg and Bremen are disillusioned; their ambitious projects are doomed, and, what is worse for them, the German U-boats have called forth against them the condemnation of the Brotherhood of the Sea. They will not be forbidden the privilege of sailing the waters of the earth or to traffic between the ports of the world, but German ships for many years to come are destined to feel the bitter resentment aroused by German piracy during this war. The Allies do not need to wage an economic campaign after peace is declared; no government will have to formulate a boycott against German shipping; that will be undertaken quietly and persistently by sailor-men themselves. The Germans have violated all the traditions of the sea, they have outraged the deepest feelings of seafaring men, they have incurred the hate of every self-respecting tar from Salem to Singapore, from Bering's Sea to the Australian Bight. It is a fact that already the British Seamen and Firemen's Union and the Big Merchant Seamen's League have joined for the purpose of boycotting everything German, and this movement has spread among the seamen of the three Scandinavian countries, all of which have felt the brutal hand of the Hun on the waters. The murders, the deliberate drownings, the mockery of the wounded and dying, of women and children as well as of men, have made the U-boats and their German masters damnable and damned wherever seamen foregather. The list of crimes committed by them is long; the stories of the British ships 'Lusitania', 'Black Prince', 'Eavestone', 'Sussex', 'Persia', and 'Leinster', the American ships 'Gulflight', 'Nebraskan', and 'Ticonderoga', the French 'Amiral Ganteaume', 'Mimosa', and 'Lydiana', the Swedish 'Snetoppen', 'Varing', and 'Vanland', the Norwegian 'Rym', 'Gurre', and 'Einar Jarl', the Danish 'Dana', 'Betty', and 'Rosborg', the Dutch 'Gamma', 'Katwijk', and Tubantia', the Portuguese fishing vessels 'Rita Segunda', 'Flor de Abril', and 'Restaurador', the Belgian Relief ships 'Harpalyce', Ashmore', and 'Euphrates,' the hospital-ships 'Lanfranc', 'Donegal', and 'Warilda', are a few from the long catalogue of crimes recorded against the German submarines. Whether belonging to their enemies or to neutrals, whether engaged in the relief of the famished or in the transport of the wounded, it was all the same to the pirates in their campaign of frightfulness. They killed 17,000 men, women, and children, on non-combatant vessels, by methods not recognized in any warfare but that of Apaches, Dacoits, or Malays. The German chargé d'affaires, the now notorious Count Luxburg, sent a telegram to Berlin through the Swedish embassy asking that the small steamers 'Oran' and 'Guazo' from the Argentine "be spared or else sunk without leaving a trace." "Spurlos versenkt" will stink in the nostrils of every sailor for a hundred years. Under cover of neutral nationality they placed spies on ships. They played every mean trick and perpetrated every form of brutality. They are outcast from the Brotherhood of the Sea.

The Gold Standard

The Editor:

Sir—The War has shown us that paper credit can be stretched to any amount; I venture to suggest that the nations should agree to stretch the world's gold reserve in the same proportion as their paper credit and carry on.

The statesmen were unable to prevent the bloodshed of the last four years. Let us hope that the financiers will evolve a plan to steer us clear of panic when this war is over. The following suggestion may be the wrong way to do this, but it will serve to provoke useful discussion.

Let us first trace the history of gold money in England, as it was in England that gold was standardized by law. Gold and silver were the standards of value hundreds of years before gold was standardized.

The pound sterling was originally a pound-weight of silver divided into 20 parts, called 'shillings', and each of these into 12 parts called pennyweights or 'pennies'. In 1345 gold first appeared in the coinage of England. Edward III by royal decree fixed the rates of gold to silver at 12½:1 in this first coinage. During the next 256 years there were nine debasements of the silver coinage accompanied by changes in the gold coinage, all of which were the arbitrary act of the reigning sovereign. The last debasement was made by Queen Elizabeth in 1601. The pound-weight of silver was then coined into 62 shillings and the pound of gold into 33½ sovereigns of 7 dwt. 4 grains each, the ratio of gold to silver being 11:1. By 1663 gold had risen in value so that it was necessary to change the ratio to 14½:1. Each time a change was made in the gold coin a new name was given to it. In 1694 the Bank of England was founded and the issue of notes began. It is an interesting coincidence that industrial disturbances started at about the same time as paper money was introduced into England by the Bank of England. During the reign of William III the guinea passed for as much as 30 shillings. In 1717 Lord Liverpool said a marked preference was shown by the people for gold money rather than silver on account of its convenience in making large payments. In 1797 many of the nobility and leading citizens of England signed a document to the Privy Council pledging themselves to receive Bank of England notes in all payments of money and to support the circulation of them. This was done for patriotic reasons. In 1816 the character of the British money system was formulated on its present basis by Act of Parliament, the essential part of this Act being the following clause:

"Xi. And whereas at various times heretofore the coinage of this realm of gold and silver have been equally a legal tender for payment of any amount and great inconvenience has arisen from both these precious metals being concurrently the standard metal value and equivalent for property;

And it is expedient that the gold coin made according to the indentures of the Mint should henceforth be the sole standard measure of value and legal tender for payment without any limitation of amount and that the silver coin should be a legal tender to a limited amount only, for the facility of exchange and commerce.

Be it therefore enacted

That from and after the passing of this Act the gold coin of this realm shall be and shall be considered and is hereby declared to be the only legal tender for payment, except as hereinafter provided.....and no tender of payment of money made in the silver coin of this realm of any sum exceeding the sum of fifty shillings at any one time shall be reputed a tender in law."

In 1816 the Commissioner of the Treasury ordered that the King's receivers and collectors should receive the guinea at 21 shillings and 6 pence, or about $5.38. Shortly afterward it was legalized as 21 shillings by Act of Parliament.

From the foregoing it will be observed:

1. That the Government could and did alter the value of coin and that the people accepted the value placed on it by the Government.

2. That the gold standard was fixed on account of its convenience.

Today paper money has been accepted by the world in general on account of its convenience.

3. It was possible to alter the value of gold from time to time arbitrarily to meet conditions then existing. Why not do the same now for the same reason?

The stretching of the margin between the gold dollar in reserve and the paper dollar issued may necessitate an alteration, so as to lessen the margin. Possibly it may be found an advantage to change the value of the metal itself, but still retain it as the standard. Whatever happens, gold must remain the standard of value. In discussing this subject, one hears 'repudiation', 'confiscation', 'instability', 'panic', and 'want of confidence' mentioned, all of which leaves a nasty taste in the mouth. Talk of this sort must be cut out. We have to face the music and evolve a solid foundation of gold under the skyscraper of paper credit, which has been rushed up to accommodate war conditions, and which an earthquake in the form of a panic might topple over, causing distress

and ruin to humanity, which has already suffered more than enough through this war.

Theoretically, perfect solvency is one dollar gold in reserve for one dollar paper issued; practically, this is not possible today. It would appear that the road to safety lies in reducing the margin as much and as quickly as possible between the paper currency and the gold reserve. There are two ways of doing this and they can be combined:

1. For the world arbitrarily to alter the standard price of gold.

2. To stimulate the production of gold, that is, make existing gold do extra duty, encourage gold mining, and produce more gold.

As it was possible in bygone days to arbitrarily fix the gold standard to meet the conditions existing then, so it should now be practicable arbitrarily to fix the standard of gold to meet the altered conditions, by the unanimous agreement of the governments of the nations.

Mr. H. C. Hoover was able, in conference with the Allies, to arrange a common breakfast-table whereby we share and share alike. Why not have a financial conference of the nations, arrange to throw the war debts into a common pot and evolve an equitable basis for liquidating it? Before this is done war indemnities should be arranged and settled on existing gold-values. The Financial Conference would hold full power from the respective governments and would bind them by acts of the Conference. At this Conference it should be agreed:

1. The governments would guarantee to pass legislation calling in all gold by a certain date against which they would issue government securities. This law would be most stringent, imposing heavy penalties and confiscation for non-delivery of gold to the respective governments.

2. The new standard value of gold would be fixed by the Financial Conference of the Nations. It might be $40 per ounce, or any other figure that the Conference in its wisdom decided; provided it was accepted by the world, the figure would not matter.

If it was fixed at double what its value is today the governments, after collecting the gold reserve, would remint the gold so that a gold coin would represent twice as much paper currency as it does now. This would cut the margin in half. The Conference would fix the actual size and weight of the coins.

The greater the lessening of the margin between the gold dollar in reserve and the paper currency issued, the sounder would be the safety of the world's finance. This readjustment would automatically give the impetus needed for gold-mining production. If the new legislation favored gold mining too much, other legislation could be framed on a sliding scale whereby the gold mines could proportionately contribute to the liquidation of the war-debt. Under no circumstances would there be any reason to curtail the gold output, as the discrepancy between gold and paper will not be sufficiently reduced for generations.

Broadly speaking, gold does not circulate today in our business, but if it did it would be a convenience if when the bank issued a $20 gold-piece it was only the size of a $10 gold-piece. It would not be so heavy to carry and it would purchase the same as if it were the same size as now. There should be no complaint. The debt of the belligerent nations before the War was about $28,300,000,000. Today it is $165,000,000,000. The gold reserve of the world today is roughly $10,000,000,000, or 17,000 tons, and the annual production about $450,000,000, of which the Allies produce 91.3%, the Neutrals 8.1%, and the Central Powers 0.6%.

Before the War, for each gold dollar there were about three paper dollars in circulation. Today for each gold dollar there are about 15 paper dollars issued. To speak of raising the standard price of gold can hardly be called 'confiscation' or 'repudiation'. If it is, then your flour, sugar, etc., are and have been confiscated. When it was found that food control was wanted the people did not complain, because they recognized it was necessary and for the welfare of all. So also would they recognize any remedy that would promote stability of finance and prosperity in the world for the general good. Of course, if a world's international clearing-house were established at the same time, it would help to regulate international finance.

W. Karri-Davies.

San Francisco, October 28.

[This letter and the one that follows come from thoughtful men and should provoke useful discussion.—Editor.]

Helping Low-Grade Gold Mines

The Editor:

Sir—I venture to offer sundry suggestions as to action on the part of the United States and the Allied governments for providing easier war-financing by laying the foundation for a League of Nations, and at the same time improving the present situation of the gold-mining industry.

1. All the present existing gold (bar, coin, jewelry, or any other form), all by-product gold hereafter mined or refined, and all enemy gold of every kind, to be considered as necessary to take care of all present outstanding contracts that require payment in gold coin of the present standard of weight and fineness.

2. All gold hereafter mined from primary gold mines in the United States and Territories to have the option, either of going into the above classification by being sold to the mints or to manufacturers as at present, or else of going to the Federal Reserve banks at a higher price per ounce under the following conditions:

Any gold hereafter mined from any United States primary gold mine may be deposited in any Federal Reserve bank with a statement as to its place and date of production; and after such statement has been verified to the satisfaction of the bank's officials, then and then only to be paid for in Federal Reserve bank-notes at a special price per ounce. If such statement cannot be verified to the satisfaction of the bank's officials, then all gold so deposited to be forfeited to the bank, with no appeal whatever on the part of the depositor.

3. Gold deposited as above to go into the vaults of the Federal Reserve banks and thus be used as a basis for issuing bank-notes. The price per ounce to be paid for such gold and the ratio to be established for issuing paper money against it to both be worked out, accepted, and adopted by all the Allied governments, each government agreeing to treat its own new and primary gold production accordingly.

As practically all of the world's new gold is being produced from Allied territory, the foregoing suggestions should not only serve to mark up the price of gold now in the ground in Allied territory, for the purpose of increasing the value of an exclusive Allied product, but by multiplying this increased value by an issue of bank-notes, should also serve as a combined means of war-financing and of war-reprisal against enemy gold and enemy financing.

If the Allied governments could get together on this gold question and provide machinery for outlawing the paper money of any nation issued contrary to any detail of the agreement thus entered into, then they would in effect have launched a League of Nations on the practical basis of an appeal to the pocketbook.

B. W. F.

Treadwell, Alaska, October 8.

Alienization

The Editor:

Sir—As an American of foreign origin, I understand and appreciate American ideals. I understand the mental bondage of the majority of European aliens in America. The 'Americanization' editorials appearing in your patriotic magazine hit the nail on the head. Nowhere in the United States has the alienization of an American community made progress as it has here in Alaska. With the opening of the Government Railroad, the Alaska Engineering Commission has shown to this present day a great preference for aliens that are foreign in language, ideals, and habits, often out-spoken anti-Americans, with a distinct hatred for American ideals and loyal Americans. Last fall in Camp 221, close to Talkeetna, all Americans were fired, to be replaced by aliens, Germans and Austrians. This spring, in the same camp, the opening of the work on this Government Railroad was marked by hiring every German and Swede in Talkeetna, and rejecting and not hiring one loyal American citizen here in Talkeetna. This discrimination against loyal Americans is and was a common occurrence on a project supposedly builded by and for the American people. Hyphenated pro-Germans and alien draft-slackers are put in charge of loyal Americans. Swedes and other aliens claimed exemption from the draft on account of not having an intention to become American citizens. They are not willing to fight for this country, but they are willing to take from American boys at the Front their jobs on an American government undertaking. The pioneers of Alaska, prospectors, miners, farmers, and merchants, in the environs of the Government Railroad, are leaving for the outside en masse. Today Anchorage, for a while the greatest town in Alaska, resembles an abandoned wild-cat mining camp. In the Matanuska valley three-fifths of the farmers left without taking the trouble to harvest their crops. The A. E. C. is paying, after a four months' service, on request, a premium of $68 to leave for the 'outside,' and if the A. E. C. is in need of labor next spring each of these stampeders will get another first-class free fare back to Alaska. To the honor of the Alaskan, it must be said that very few are taking advantage of this doubtful privilege for patriotic reasons. Only publicity will remedy the scandalous conditions created by the Alaska Engineering Commission.

HENRY LEGIN.

Talkeetna, Alaska, October 4.

[We are surprised to receive this description of labor conditions at Anchorage and hope that it is exaggerated. However, we deem it right to publish this protest, which appears to be made in good faith.—EDITOR.]

The Utah Copper Enterprise

The Editor:

Sir—Reading the fourth article of this series recalls vividly to my memory the following, which will be of interest to many of the earlier residents at Bingham.

In the year 1871 I was employed as a contractor at the Winnemuck mine. Al Bemis was the manager of the mine and small smelter, about half a mile below the town. The principal hotel was named Hotel Clark. Below it, and on the west side of the gulch, was a large rooming-house owned by Richard Predeux. George A. Jackson, one of the first miners to reach Central City, Colorado, during the Pike's Peak excitement, was placer-mining just above the Clark hotel, and close to the junction of the two gulches. Warren Hickman, son of Bill Hickman, a notorious Mormon character, was postmaster. A short distance above the junction, in the left-hand gulch, the post-office, main store, and Justice of the Peace were located. Some tunnels had been driven into the mountain, but abandoned at this time. Sol. Cleveland, a nephew of Jackson, was owner and manager of a boarding-house in Galena gulch. During a suspension of work on one of the mines, several miners continued to board with Cleveland. Cleveland entered into a verbal contract with two, who wanted to try prospecting. He was to furnish board, tools, and powder; they were to find a property and do the work.

About three months after the contract was made, a miner, returning from town, told Cleveland that his partners were about to sell a mine. The parties did not arrive at the boarding-house that night. About ten o'clock the next day Cleveland went to town, and soon learned that a trade was on for the mine at the office of the Justice of the Peace. He arrived there when the buyer was reading one of the papers that had been drawn up. Listening carefully, he learned that he was no party to the transaction. Excitedly, he told the purchaser he was a third owner in the mine, and no deal would be made unless his interest was recognized. Instantly one

of his partners denied the ownership, and invited Cleveland outside to settle the matter. Passing out of the door in advance of Cleveland, he grabbed a stone and poised himself to throw it at Cleveland, who shot him, and he fell over the steps of the office. Cleveland then entered and shot the second partner as he stood by the side of the Justice and the purchaser. He drew a second revolver from his boot-leg, and, with one in each hand, he walked a hundred feet up the gulch, and entered a tunnel driven into the side of the mountain.

By this time a crowd began to accumulate, and many were shouting, "Hang him," "Shoot him"! Among the number rushing up was Jackson, who was surprised to learn that the man wanted was his own nephew. "If you want the man," Jackson said, "I will bring him to you—but no shooting or hanging will be done until after he has had a fair trial. Now, if ten men will promise me they will escort him to the Justice's office, and allow him to have a fair trial, I will go into the tunnel and bring him out."

This was agreed upon, and in a few minutes Cleveland and Jackson came out, both heavily armed, and escorted between the ten men who had promised to protect him. They went to the Justice's office. A trial was held, and Cleveland was set free.

GEORGE KISLINGBURY.

Los Angeles, October 28.

Producers of Lead

The Editor:

Sir—Herewith a communication of which the letter to Lead Producers Committee is a part. I trust you may find it acceptable. The smelters are going to force operators to seek other markets and as for the American (capital) production in Mexico, its only outlet is Japan, whose representatives are now investigating the field.

It has been with gratification that the mine-operators have noted the many profiteering trusts and manufacturers fall under the control of the Government regulations and their prices and profits fixed. The gratification has been in the expectation that the Government would in due time take note of the real detriment to mining—the arbitrary method of the smelters and the smelting combinations in confiscating a large percentage of the mine products delivered to them for refining. The Government has now fixed the prices of the various minerals that the smelters shall receive, but there has been nothing done as yet to fix the price that the smelters shall pay to the miners who sell them the metals. It is my legal opinion that a judicial decision from a judge of the higher courts would say, in the case of the recent fixing of silver-values, that the smelters are guilty of not conforming to the prices, likewise as to copper.

The mine operator has no other alternative than to deliver his product to the smelters. The following letter to the Lead Producers Committee shows smelter methods exactly as they exist in respect to lead. Copper, silver, and gold are in the same boat. Based upon the tariff referred to, a shipment that I have just made shows as follows: Gross difference between the amount actually paid by the smelter and New York prices, $58.60, or net, after deducting smelting loss and bullion freight-charges to a shipping port, of $4.13, $53.87 per ton of ore. A total of $2154.80 per car of ore.

If the real producer, the mine operator, could get this profit, there would be no occasion for "stimulating" or asking a Government bonus on metals production.

S. L. PEARCE.

Alamos, Mexico, October 20.

[Here follows the letter to which Mr. Pearce refers in his communication to us.—EDITOR.]

ALAMOS, SON., MEXICO, October 19, 1918.

Lead Producers Committee,
Washington, D. C.

Gentlemen:

Quoting from the MINING AND SCIENTIFIC PRESS of date October 12:

"Lead. All the metal available, every ton and every pound, is under the strict control of the Lead Producers Committee, etc. There is at present no relief in sight on this score."

Apropos: The mines, not the smelters, being the 'producers,' who is retarding production, the producer or the smelter?

A late schedule from the American Smelting & Refining Co.'s purchasing department, compared with the market-value of lead, will furnish the answer. The producer must pay the smelter for treating his ore a flat rate of $6 per ton, plus penalties of a like sum; must present them with two units, 40 lb., plus 10% gross on each ton of ore, or for an average ore of 30% lead content, 600 lb., the smelter pays for only 500 lb. They make similar deductions on other marketable content of the ore, even imposing a penalty for some elements that are in urgent demand of the War Board. They get full pay for treatment of the ore, and force the producer to sell to them the 500 lb. of lead at exactly 0.03761c. per pound and they take 100 lb. and pay nothing for it. They pay no duties to the U. S. government on imported ore, but ship it in bond and sell direct to the foreign market. For one ton of 30% lead ore, they charge their own price for treatment. The net content of the ore is 600 lb. of lead, at New York price of 8.05c., or $48.30. They pay 0.03761c. for 500 lb., or $18.80. They do lose in treatment perhaps 2%, or 12 lb. of lead, 0.72c., and they pay about 0.6c. per 100 lb., or $3.53, freight-charges to port, yet there is a difference in their favor of $26.25 per ton, or $1050 per carload. Give the mine operator, the real producer, this highwayman's toll and there will be a surplus of lead to present to the Kaiser via the rifle-route.

If the Honorable Lead Producers Committee will place a purchasing agent at the smelters and pay the producers the price the smelters are receiving for the lead, it will solve the shortage very quickly. The one camp in which I am trying to produce, but am forced to throw 40% lead ore into the waste—would furnish thousands of tons of ore if the market-values could be had. *Spero meliora.*

S. L. PEARCE.

Smelting Cyanide Silver-Precipitate in Oil-Burning Reverberatory Furnaces

By K. A. CUNNINGHAM and ARTHUR FEUST

As a result of the embargo placed by the United States government on the exportation of graphite crucibles, operators in the Guanajuato district, as well as others in Mexico, found themselves face to face with the difficulty of dealing with their cyanide precipitate, which theretofore had been melted in crucibles. Several methods of disposing of the precipitate were available: First, it could be sold to the smelters; second, it could be smelted in one of the numerous brick-lined oil-fired tilting furnaces; and, third, it could be smelted in reverberatory furnaces.

The objections to the first method were several, among which were the difficulty in getting accurate samples, and the length of time necessary before final settlement is made, the smelters advancing only 75% on receipt of the precipitate, although lately they have offered 90%. Besides, consideration must be given to the packing in the transportation of a considerable volume of precipitate. The objection to the second method was mainly the small capacity of the different types of tilting furnaces, which also require a considerable expenditure of capital. The delay in receiving shipments from the United States, which nowadays occupies from two to four months, was also a serious drawback.

This brought the producers down to a consideration of using reverberatory furnaces, as was the case with the Mexican Milling & Transportation Co. The practice employed by this company, and the results obtained, are given below, together with drawings of the furnace employed. The furnace is practically identical with that of the Compañia Real del Monte y Pachuca, since D. S. Calland, managing director, kindly furnished the Guanajuato operators with drawings of the furnace used by his company. The chief difference between the Real del Monte furnace and that built by the Mexican Milling & Transportation Co. is that the latter is three feet shorter from the centre of the tapping-hole to the throat. Also, the base of the Mexican Milling Co.'s furnace is built of rubble masonry, whereas that of the Compañia Real del Monte y Pachuca consists of piers on which rails rest, supporting the bottom of the furnace. In the Pachuca practice the furnace was charged through ports in the roof, whereas in the practice of the Mexican Milling & Transportation Co. it was charged from the firing-end. After the rubble foundation was in place, a bed of brick-bats and lime and mortar was prepared, on which the firebrick was laid. As no arch-bricks were available, ordinary firebricks were cut to shape, the faces being rubbed so as to get as close a fit as possible. An extremely thin fireclay mortar was used in laying the brick, considerable care being exercised to avoid leaving any interstices. That this care was justified was proved afterward when the hearth was removed; it was found that the absorption of bullion and matte had been very small. After the roof-arch was in place, with both ends of the furnace bricked in, and the dust-chamber and the flue finished, a wood fire was started in the centre of the hearth. It was small at first but gradually increased. This was continued for 10 days, when the furnace appeared to be thoroughly dry; then the oil-burners were turned on for several hours each day for an additional four days. After this, the burners were turned on full blast, and the furnace was brought to a cherry-red heat, this being gradually raised to white-heat. At this point 300 kilogrammes of old slag was charged gradually, and the greater part of this was absorbed by the hearth. When the hearth refused to absorb any more slag, the burners were turned off, and the furnace allowed to cool. Inspection showed that the bottom was glazed, and that there were no openings or checks except in the roof-arch, but as this was afterward covered with sand there was little loss of heat.

A day or two before charging the furnace the hearth was painted with a thin solution of fireclay to fill any crevices, this operation being repeated before every succeeding melt. The furnace, now being ready, was operated regularly once a week during the months of April, May, and in the first week of June, the melts taking from 16 to 28 hours. Just prior to charging the furnace, the tap-holes—there being three in use, one for metal, and the other two for slag—were closed with adobe, and the tapping-bars were driven into place. These bars are one inch in diameter. We have found it advisable that before starting to draw the bar from the lower tap-hole, through which the metal comes, it is always better to drive it into the furnace in order to loosen any chilled metal that may have accumulated on the point. In our operations at the Mexican Milling & Transportation Co.'s property the slag was tapped after the molten mass had become quiescent, and as close to the metal as possible, then the heat was continued for about one-half hour in order to oxidize as much of the impurities as possible before tapping the metal. The slag was tapped into the conical molds formerly used for the slag from the crucibles; the molds being run away in specially constructed buggies. As soon as the slag in the molds was chilled on the outside, the molds were tapped so as to leave only the skulls, these being charged back in the next melt, be-

cause they are richer than the slag. The analysis of the slag is given in the table. The skulls, however, form but a small part of the total slag. The bullion was tapped directly into bullion molds, which were set on an iron truck running parallel to the furnace. With a little practice it is easy to decide as to the exact size of the bar necessary to give a stream of metal that can be controlled easily so as to avoid slopping over in moving the truck along. Unless there was a considerable quantity of matte produced in melting, we found it unnecessary to re-melt the bars, but there were occasions when the bars had to be re-melted on account of the tenacity with which the matte adhered to the bullion, it being practically impossible to remove it. During the last month in which the furnace was operated, but little trouble was experienced with the matte, notwithstanding the fact that concentrates were being cyanided. This accounts for the high sulphur content of the precipitate. The precipitate is not treated with acid nor is it roasted; the shorts, however, being screened and returned to the head-compartments of the zinc-boxes.

During the period of two and a fraction months a total of nine melts, consisting of 5331 kg. of precipitate, were charged. The precipitate produced 2529.254 kg. of bullion, distributed as follows:

Month	No. melts	Bullion, kg.*	Assay—Gold, kg.	Assay—Silver, kg.	Total contents—Gold, kg.	Total contents—Silver, kg.
April	4	1266.839	16.387	883.546	20.760	1119.334
May	4	1097.187	15.039	848.098	17.598	930.524
June	1	165.228	15.360	868.345	2.538	143.475
	9	2529.254	16.169	867.186	40.896	2193.333

*1 kg. = 32.15074 Troy ounces.

The chief anxiety of the operators employing reverberatory furnaces was as to the amount of loss in dust and through absorption into the hearth. After a run of a trifle over two months it was decided to take up the hearth and clean the dust-chamber, so as to ascertain exactly what these losses were. The results of this investigation are as follows:

Final Clean-up of Reverberatory-Furnace Hearth

Product	Weight, kg.	Assay—Gold, kg.	Assay—Silver, kg.	Contents—Gold, kg.	Contents—Silver, kg.
Metal bars (3)	86.669	16.938	837.968	1.468	75.746
Concentrated brick	1080.000	0.024	3.566	0.026	3.851
Matte and slag	206.600	0.1167	13.418	0.024	2.772
				1.518	82.369

Of the metal recovered in the final clean-up 46 kg. was in one slag frozen just inside the tap-hole, and although this was regarded as a part of the absorption, it really was actual bullion produced. From the foregoing figures it will be seen that the absorption by the hearth is equal to 3.57% of the total gold content and 3.61% of the total silver content of the products recovered. Almost all this absorption occurred in the first and second melts. Likewise, as the operating crew became more experienced, the time required per melt was reduced from the original 28 hours to 16 hours required on the last melt. This time was reckoned from the beginning of the clean-up of the zinc-boxes, the precipitate being charged from time to time as fast as the furnace was sufficiently heated. The precipitate, when charged, contained an average of 40% moisture. The clean-up of the dust-chamber, which is divided into two sections, gave a total of 8 kg. Of this amount 5 kg. was recovered from the chamber following the fire-bridge, and assayed 150 gm. gold and 10.920 kg. silver per metric ton, (1 kg. per metric ton = 29.1755 Troy oz. per Avoirdupois ton). The second chamber, parallel to the furnace, gave 3 kg. of flue-dust assaying 76 gm. of gold and 8.124 kg. of silver per metric ton. It will be seen from this that the percentage of loss from dusting is practically negligible. A typical analysis of the precipitate follows:

Analysis of Precipitate, M. M. & T. Co.

	July, %	August, %
Silver	48.33	49.65
Gold	0.88	0.89
Lead	0.87	0.70
Copper	8.82	7.10
Insoluble	5.40	5.80
Iron	1.16	1.30
Alumina	0.53	0.48
Manganese	trace	trace
Lime (CaO)	3.52	4.55
Zinc	15.50	15.60
Sulphur	11.54	11.09
Loss and undetermined	3.45	2.84
	100.00	100.00

The fluxes used in the reverberatory furnace during the nine melts, and the equivalent percentages, are shown below:

Fluxes

	kg.	%
Borax glass	467	8.76
Soda ash	674	12.64
Broken glass	679	12.73
Lime (CaO 50%)	113	2.12
	1933	36.25

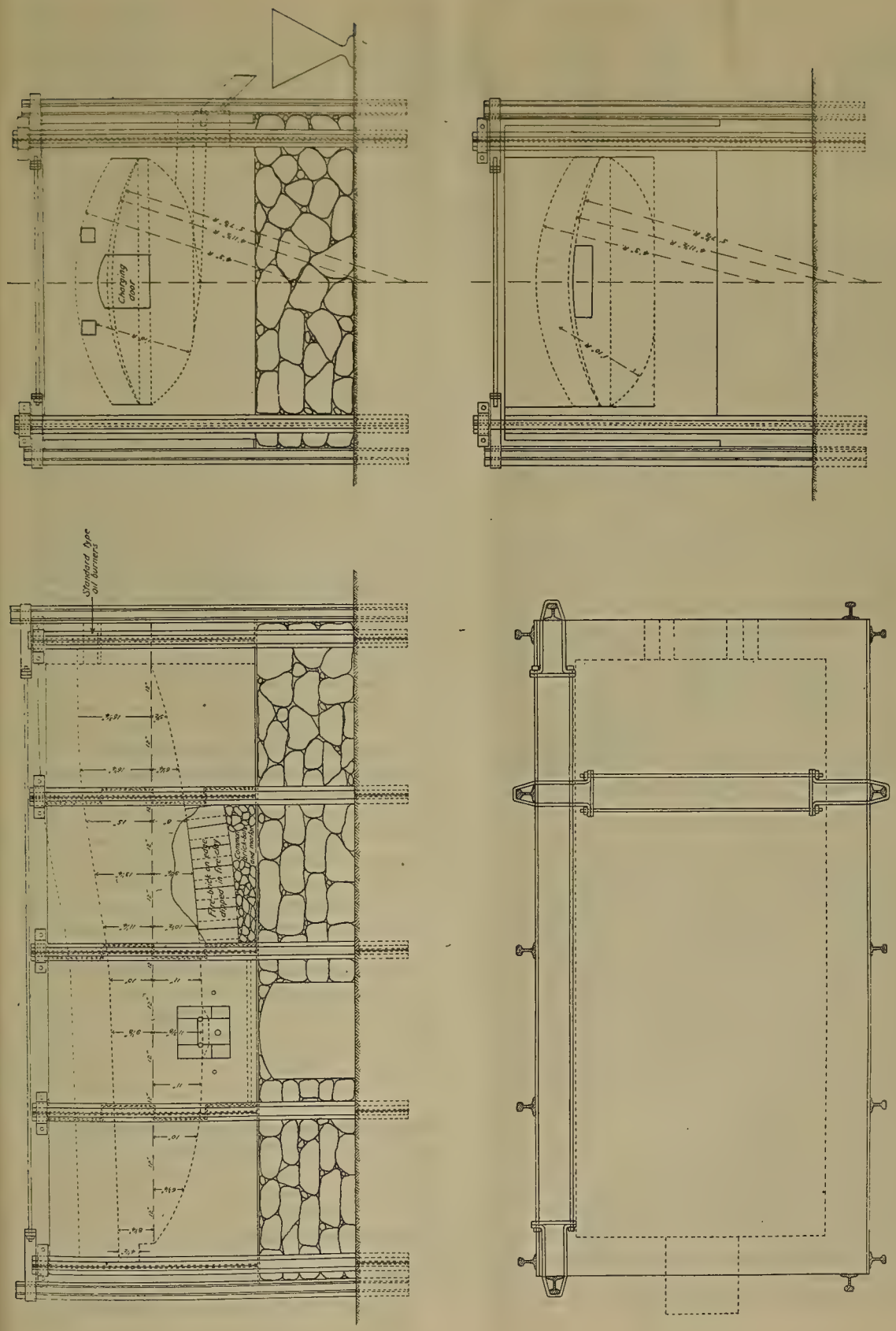
During the nine melts there was consumed a total of 8100 litres of Mexican gas-oil, which costs 5 cents U. S. currency per litre at the mill. This is equal to 3.569 litres of gas-oil per kilogramme of bullion produced. In order to make a comparison of the reverberatory method of reducing precipitate with the melting in crucibles, from a standpoint of fluxes consumed, the following record of the amount of fluxes used during the month of July, in melting 2033.4 kg. of precipitate, which produced 1065.345 kg. of bullion, is appended:

Consumption of Fluxes

	kg.	%
Borax glass	178	8.750
Soda ash	269	13.229
Broken glass	530	26.064
Lime (CaO 50%)	51	2.508
	1028	50.551

This precipitate was melted in four No. 250 Japanese graphite crucibles, costing $60 U. S. currency per crucible. These crucibles are nearly equivalent to a Dixon No. 275. The amount of gas-oil consumed was 3660 litres, equal to 3.436 litres per kilogramme of bullion produced.

In addition to the fluxes used above, iron was supplied to the slag in the form of old pieces of wrought-iron pipe. This was added in the reverberatory and in the crucible melts. Typical analyses of the two types of slag, that is, the reverberatory and the crucible-slag, are appended, and from these it can be seen that the reverberatory gave a far cleaner slag.



REVERBERATORY FURNACE FOR TREATING CYANIDE-PRECIPITATE

Analyses of Slags

	Crucible slag, %	Reverberatory slag, %
Gold and silver	0.014	0.003
Lead	0.28	0.35
Copper	0.15	0.10
Silica	32.12	31.34
Iron (FeO)	5.50	4.25
Aluminum (Al)	0.80	0.60
Lime (CaO)	9.10	8.10
Zinc	17.12	16.50
Sulphur	21.66	23.05
Sodium (Na)	2.77	3.00
Boron (B)	2.60	2.81
Loss, oxygen, etc.	7.886	9.897
	100.000	100.000

While the analyses of the slags are almost alike it will be noted that the amount of broken glass added, when melting in the crucible, was more than double that used in the reverberatory furnace, since the reverberatory furnace-slag derived its SiO_2 from the hearth. This was deduced after considerable experimenting to find the best quantity in order to prevent the precipitate from attacking the crucibles. The average crucible lasts from three to four melts. The bottoms of the crucibles are protected by several firebrick at the point where the flame from the burner impinges, but it is notable that the majority of the crucibles that fail in less than three melts do so at the point where the flame strikes them, while the others, as a rule, cut through at the slag-line.

As the result of the work done at the Mexican Milling & Transportation Co.'s plant, the following conclusions were reached: First, there is a big saving in the melting in the reverberatory as against crucibles at the present high prices; second, a cleaner slag with a higher grade of bullion can be produced than when melting in crucibles; third, a considerable saving can be made in the amount of fluxes consumed, although the consumption of oil was a trifle higher on account of the amount of heat absorbed by the furnace; the oil used would be less if the furnace were running steadily; fourth, when using the reverberatory one is not dependent on the receipt of crucibles, the arrival of which is irregular, to say nothing of the troubles and losses from broken crucibles and the consequent mess that they make when they cut through. Were it not for the fact that this plant is running on a close margin, and that it is impossible to hold bullion in suspense, as is unavoidable in operating one of these furnaces, the practice outlined would be continued without hesitation. The total cost of the furnace, with the dust-chamber, including the firebricks, which are manufactured in Mexico, in addition to the castings, rails, tie-rods, and accessories, was $1045.15 U. S. currency. This figure does not include the cost of the stack, as a charcoal-furnace already erected was employed; neither does it include the bullion or slag-molds, which were on hand.

PREPARATION OF COLLOIDAL GOLD. New glassware should be employed and should not be used for any other purpose. After cleaning with soapy water it is rinsed with aqua regia, then filled several times with tap-water, and rinsed, and then with triple-distilled water just before using. The water should be triple-distilled from a block-tin condenser without rubber connections. Place 1000 cc. of the water in a 2-litre flask, add 10 cc. of 1% $AuCl_3$ solution and 7 cc. of 2% K_2CO_3 solution. Heat rapidly to boiling, remove from the flame, and, with constant agitation, add 4 cc. of 1% HCHO; continue the agitation while the color passes through blue and amethyst to red. This is the final product, and should conform to the following requirements: It should be bright orange-red or salmon-red in color, neutral in reaction, and 5 cc. must be completely precipitated by 1.7 cc. of a 1% solution of NaCl in one hour. If the solution fails to work properly it should be discarded and, after thorough re-cleaning of all glassware, another solution made up. It is usually a waste of time to try to 'correct' a poor solution.

Tungsten in China

A United States 'Consular Report' dated August 31, at Hongkong, says:

"Predictions made in reports from this office a year ago that the deposits of wolframite in southern China, including an area in the colony of Hongkong, would prove to be one of the most important additions to the world's supply of this ore discovered in recent years, have been amply fulfilled by the development. Shipments of ore from Hongkong alone, not including Canton, Swatow, and other points made through Shanghai and other trans-shipment ports, have totaled $1,831,590 (U. S. currency) so far for the current year. The ore generally is valued at $1000 per ton. Shipments during the first quarter were $124,286; for the second, $696,899; while for the first two months of the third they were 2,016,388 lb., valued for invoice purposes at $1,010,405. Shipments may now be said to be in full swing. The number of Chinese interests involved in the collection of the ore in much of the Kwangtung, Kwangsi, and Hunan provinces has increased until there is a veritable boom in the business, while the industry has proved to be of immense benefit to Chinese labor, whose ordinary occupations have been interfered with by the shutting-off of exports in other lines. The ore is generally found in isolated deposits or pockets scattered over a wide area. Various systems of managing the mining have been tried, with the result that at present by far the greater part of the ore is purchased by middlemen from Chinese operators who manage the mining and secure and deliver the ore in Hongkong, Canton, or Swatow in their own way. Even where deposits are owned by the exporter of the ore the mining is generally done on a 'piece' basis."

GOVERNMENT reduction plants in Western Australia have aided development of small mines to a considerable extent. To the end of June 1918, these works (stamp-mills) had crushed 1,172,829 tons of ore, yielding gold worth £4,142,588 ($19,886,000) by amalgamation, £600,794 ($2,880,000) by cyanidation of sand, and £173,406 ($830,000) by slime treatment. Also 74,415 tons of tin ore yielded oxide worth £89,550 ($430,000). The total extracted by all processes is £5,006,599 ($24,026,000).

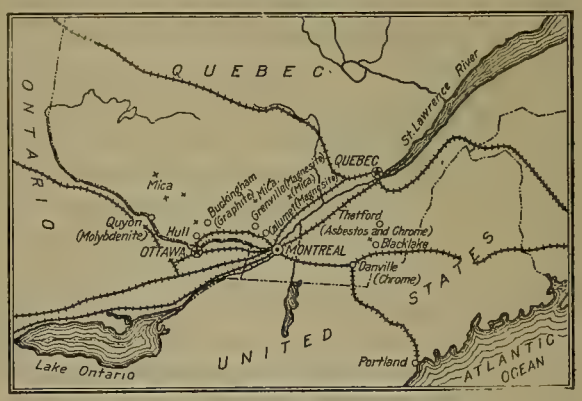
Asbestos, Chromite, Graphite, Magnesite, Mica, and Molybdenite in Quebec

*Quebec is a large producer of these important, but not generally abundant minerals. The following review of the production in 1917 reveals how great has been the stimulus due to the demands of war.

MAGNESITE: During 1917 the magnesite marketed by operators in Quebec reached a total of 58,340 tons, valued at $729,025. This quantity represents crude, calcined or caustic, and dead-burned or sintered magnesite. Had the magnesite been all marketed as crude the quantity would have been about 64,000 tons. The Scottish-Canadian Magnesite Co., whose quarry is situated in Grenville township, worked steadily all the year. The quarry is now connected with the C. P. R. line by a narrow-gauge railway 13 miles long, which joins the main line at the junction point called Magnesite, five miles east of Calumet station. The main excavation measures 150 by 30 ft., and the depth is approximately 40 ft. The equipment is adequate for a production of 150 tons per day. Some of the ore is shipped to the plant of the Canada Cement Co. at Hull, where, by an agreement between the two companies, the Scottish-Canadian Magnesite Co. is using with good results the cement-kilns for the production of dead-burned or sintered magnesite. For this purpose, the raw magnesite is broken by a gyratory crusher, and mixed with iron ore, so that the sintered product may contain 8% of iron oxide (FeO). The iron ore used is a magnetite from the Forsyth mine, at Ironside, near Hull. From the crusher the mixture goes to a ball-mill. It is then fed into a cement-kiln in which the temperature reached 2400° F. The sintered magnesia is in nodules one inch in diameter and less. After cooling, it is put into bags.

The North American Magnesite Co. operated its quarry, known as the McPhee mine, in Grenville, also the Dobbie property in Harrington township, which it leased from the International Magnesite Co. The quarry on the McPhee is now 150 by about 90 ft., and has a depth of 50 ft. There is a calcining-kiln at the mine, producing caustic magnesite which is used in the chemical trade. The product of the kiln, 10 tons per day, is shipped to the United States. The North American company rented the Vulcan mill of the Canada Cement Co. at Longue-Pointe, and is now producing dead-burned magnesite. The raw magnesite is mixed with some of the Hull magnesite to supply the bonding medium, as in the case of the operations of the Scottish-Canadian Magnesite Company.

It is undeniable that the development of the Quebec magnesite industry is due directly to the War. For refractory purposes, such as for bricks used in lining furnaces, there existed a strong prejudice against the Quebec magnesite, owing to its rather high content of lime, which is 5 to 12%, and to its lack of cohesion under high temperature. This lack of bonding quality, from which the Austrian magnesite does not suffer, is due to the almost total absence of iron. The Austrian product contains from 5 to 10% of iron oxide, whereas the Quebec magnesite is much lower, as a rule not exceeding 1½%. It might be thought that the lack of iron oxide could easily be remedied by the addition of some iron ore, such as limonite, hematite, or magnetite, but it appears that the iron oxide in the Austrian magnesite is in a state of fine



PART OF QUEBEC, SHOWING ASBESTOS, CHROME, GRAPHITE, MAGNESITE, MICA, AND MOLYBDENITE AREAS.

division, or dissemination, which cannot easily be duplicated in a mechanical mixture, this imparting a particularly good bonding quality when submitted to the heat of the furnace. After a great deal of experimenting, the Steel Co. of Canada, at Hamilton, Ontario, evolved a satisfactory method of using the Grenville magnesite for the bottoms of its hearth-furnaces. After calcining the crude magnesite, it is broken into half-inch pieces, and mixed with 15% of a blast-furnace slag containing 15 to 20% iron oxide and 50% lime. The furnace to be lined is heated to a temperature sufficient to melt the slag, and the mixture of slag and calcined magnesite is spread over the bottom in thin layers until the required thickness has been attained. During the operation of lining the temperature of the furnace is kept at 2700° F. From a communication received from the Steel company, it appears that the results are quite equal to those obtained from Austrian magnesite. As to the walls of the steel furnaces, F. R. McKune, of this company, obtained satisfactory results when using a mixture of dead-burned Grenville magnesite, caustic magnesite, and magnesium

*Notes from Annual Report for 1917 of Theo. C. Denis, Provincial Superintendent of Mines.

chloride. This mixture forms a plastic mass, which can be applied with a trowel to the walls of the furnace and allowed to set for 24 hours. Heat has to be applied gradually. This replaces the magnesite brick of which such walls are usually built. As to the manufacture of brick from Quebec magnesite, it has been stated that lime in magnesite will cause the dead-burned article to absorb moisture and to slake to a harmful extent. A series of tests showed that the Canadian dead-burned magnesite, carrying as much as 16% of lime, does not slake to any extent, even after fine-grinding and prolonged exposure to moist air.

MOLYBDENITE: The Quebec molybdenite industry made much greater progress during 1917 than the figures of production indicate. Much of the work during the year, such as the exploration, diamond-drilling, and improvement of concentration methods, is not reflected in these figures, but will, without doubt, appear prominently in the 1918 production. The total quantity of molybdenite produced in the Province was 226,739 lb., valued at $238,-096. This comprises various grades of concentrate, some of which sold as high as 95%; but most of the molybdenite that was marketed assayed 75% and higher. In May 1917 the Moss mine, near Quyon, which had been developed with such good results in 1916 by the Canadian-Wood Molybdenite Co., was acquired by a syndicate, representing strong United States interests. The Dominion Molybdenite Co. was organized with a capitalization of $5,000,000, to operate it. A great deal of work has been done since they acquired it. From June to October, 12,000 ft. of diamond-drill holes were put down, under contract, by the E. J. Longyear Co. The results of this exploration are said to have been most satisfactory, and a large reserve of ore has been blocked. Numerous experiments were made on the concentration of the ore. The Wood flotation machines, installed by the Canadian-Wood Molybdenite Co., yielded a concentrate of comparatively high grade, but with low recovery. After a series of tests, the Callow process was adopted, and a mill capable of dressing 150 tons of ore per 24 hours was erected. The results have been satisfactory. The mill practice is as follows: From the coarse rock-bin, the ore passes over a grizzley, the oversize going to a 10 by 20-in. and the undersize to a 9 by 16-in. crusher. The crushed rock is stored in a 200-ton bin, from which it is fed to a Marcy mill. From there it goes to a Dorr duplex classifier, then to four Callow roughers, which effect a first separation into concentrate and tailing, the latter going to the dump. The concentrate then goes to two Callow cleaners, which separate it into heading and middling, the latter returning to the roughers, making thereby a closed-circuit. The concentrate is de-watered, dried, and sampled. During the year 1917 practically the whole production of the Quyon mine was taken by the Imperial Munitions Board. The Wood Molybdenite Co. acquired a promising prospect in Huddersfield township, and actively pushed the development in 1917. The company erected a small mill for concentration of the richer ore. J. A. Bancroft was commissioned by the Quebec Mines Department to make an examination of the mode of occurrence of the molybdenite deposits in Huddersfield.

CHROMITE. The production of chromite shows that 36,186 short tons, valued at $498,031, was produced during 1917. This is greater than the quantity actually shipped to the consumer, as a proportion represents low-grade ore of 12 to 25 or 30% Cr_2O_3, sold by miners to concentrators, where it was enriched to 45 or 50%. The quantity that reached the consumer was about 23,000 tons. These figures constitute a new high record. The Mutual Chemical Co. of Canada operated successfully its Black Lake concentrator as a custom-mill through the year. This plant was overhauled in 1916, and consists, in the main, of a 9 by 15-in. Blake jaw-crusher, reducing the ore to 2 in.; thirty 950-lb. stamps, which reduce the ore through 20-mesh screens; and seven Wilfley tables. The capacity of the mill is 70 tons of ore, averaging between 12 and 15%, from which approximately 66% of the chrome content is recovered as a 50% concentrate.

GRAPHITE. The production of graphite in Quebec also reached record-figures, both in quantity and in value. They show 1,078,000 lb., valued at $99,024, an average of 9.2c. per pound. This is an increase of 12.6% in quantity, and of 30.7% in value, when compared with 1916. The production of graphite in the province of Quebec was restricted to the vicinity of Buckingham. The Plumbago Syndicate, consisting of Toronto men, operated its mines and mill for seven months, shutting down in August 1917. This was necessitated by a combination of circumstances, namely, the scarcity and inefficiency of labor, the shortage of coal, and the unsatisfactory results obtained by the method of concentration employed. The Syndicate took over the properties of the Dominion Graphite Co. in the latter part of 1914, and for more than a year and a half H. P. H. Brumell was in charge of the operations. When he left in 1916 for Alabama, R. E. Leighton of Montreal was appointed consulting engineer, and he carried on extensive experiments in the dry concentration of the ore. In August 1917, when the property was visited by an official of the Bureau of Mines, the mill was treating 50 tons per diem of graphite-bearing rock, the graphite being disseminated in sillimanite gneiss and adjoining crystalline limestone. From this it was claimed that four tons of shipping product was recovered. The graphite produced consisted of No. 1 flake, assaying 90% plus of carbon; No. 2 graphite, assaying 60%, used for lubricants; and No. 3, fine graphite for foundry use and for the manufacture of paint. The ore fed into the mill was reported to contain an average of 14% graphite. The mill used is the one that was constructed by the Dominion Graphite Co., and the ore as it comes from the mine goes over a grizzley. The lump ore goes to two masonry drying-kilns, and the fine goes to a rotary-dryer. The dry ore is then crushed, put through trommels and over sizing-screens, through roll-crushers, over dry separating-tables, and the graphite is finished between stones and bagged. The process being dry throughout, the dust that permeated the whole mill

was a great inconvenience. The plant finally was shut-down at the end of August, although it is claimed that the products obtained were satisfactory. The company is now testing oil flotation, and if the results prove satisfactory, the system will be discarded. While in operation, during the first part of the year, there were 60 men employed, of whom 11 were in the mill.

The New Quebec Graphite Co., a British company, worked throughout the year. The mill was constructed in 1913 by the Quebec Graphite Co., the predecessors of the present company. The concentration process is a wet one, and seems to give satisfactory results. It is based on careful sizing. The ore is broken in jaw-crushers, passes through rolls, after which it is pulverized in a ball-mill. The product is carefully sized in trommels in double series, giving three sizes, which are sent to hydraulic classifiers. This is followed by treatment on 16 concentrating tables (Krupp-Ferraris). The concentrate containing 60% carbon is then de-watered in a large cylindrical-vacuum vessel, the bottom of which has a fine-mesh metallic cloth, through which water is drawn by suction. The de-watered concentrate is shoveled to trays placed in tiers on trucks, which are wheeled into a long drying-room where the remainder of the water is evaporated. The concentrate then passes through a 'Sech' pulverizer, which consists of a series of highly-polished steel rolls which crush the impurities. These are eliminated by passing over a table with bolting-cloth, and the product is a graphite concentrate containing 80% or more of carbon. The power is supplied by a 160-hp. Diesel engine, burning crude oil.

Mica. The figures, compiled from returns received at the Quebec Mines Branch, show that 1,531,629 lb., valued at $281,234, was marketed. It is rather difficult to present systematic statistics of the production of mica, owing to the diversity of products and to the divergence in prices. The mica is marketed in several forms, of which the chief are thumb-trimmed, thin-split, scrap, and pulverized. Scrap and pulverized mica bring from ½ to 2c. per pound, whereas large sheets of thumb-trimmed sell as high as $2. The thin-split mica, which is split into sheets of 1/1000 to 2/1000 inch thick, that is, about the thickness of ordinary paper, represents a further stage of preparation. Only small sheets, under 1 by 3 in., are thin-split, being used for the manufacture of 'micanite,' which is a plate built up of small thin pieces of mica cemented by shellac and submitted to hydraulic pressure. The ruling prices for mica toward the end of 1917, for standard sizes, thumb-trimmed, were as follows, per pound:

Inches		Inches	
1 by 1	$0.08 to $0.10	2 by 4	$0.60 to $1.00
1 " 2	0.12 " 0.16	3 " 5	1.30 " 2.00
1 " 3	0.18 " 0.30	4 " 6	1.70 " 2.50
2 " 3	0.35 " 0.55	5 " 8	2.25 and over

Asbestos. The total quantity of asbestos-bearing rock mined and hoisted during the year was 2,634,410 tons. The value of the asbestos obtained from it, including stocks on hand at the end of the year, was $8,120,409. This represents $3.08 worth of asbestos from each ton of rock. In 1916, 1915, and 1914 the corresponding values were $2.13, $1.46, and $1.44. The production of asbestos was 137,242 tons, valued at $7,198,558, compared with 133,339 tons valued at $5,182,905; the average price per ton rose to $52.45; in 1916 this was $38.87; in 1915 it was $31.33; in 1914 it amounted to $26.96; and in 1913 was represented by $28.04. From May 1, 1917, the only royalty on asbestos, payable to the Provincial government, was 2% of the gross value of the mineral extracted. Fourteen companies were operating. At the King mine of the Asbestos Corporation of Canada, extensive alterations, both in the mine and the mill, begun three years ago, have been practically completed. The large covered storage-bin for the dried rock, with a capacity of 25,000 tons, is now being used. It feeds the mill by means of conveyor-belts. The new crushing and drying-plant is also in operation. It includes two 32 by 72-in. jaw-crushers, with a capacity of 100 tons per hour, having vertical dryers. The rock hoisted from the pit passes through the crushers, and thence through the dryers. It falls into the boots of bucket-elevators and is raised to the upper part of the bin, in which a conveyor-belt distributes it evenly. The contents of the storage-bin are discharged at the bottom by a series of openings upon a belt that feeds the mill. In the east Broughton field, the Quebec Asbestos Corporation, after extensive alterations to mill and mine, began producing in May 1917. The cable-derricks have been discarded, and the rock is handled in the pit by steam-shovels and cars, which convey it to crushers in the pit-bottom. The crushed rock is then brought to the surface by elevators and dropped upon a conveyor-belt, which discharges into the dryer-bins. The asbestos industry employed a total of 3154 men.

Metal turnings and borings from lathes at mines are generally thrown away, unless they are sold as old metal. This material always contains a good deal of high-grade oil, which should not be allowed to go to waste. The turnings may be put in a sheet-lined receiving-truck, having a sloping bottom to allow of their draining. Then they are placed into an oil-separator—steam-heated or centrifugal type—which reclaims most of the remainder of the oil. A large milling machine company at Cincinnati recovers an average of 100 gal. of oil daily.

'Fatigue' is a term used to embrace collectively the phenomenon of deterioration of material due to continued stress beyond the elastic limit, to repeated shock or vibration caused by mechanical braking or slipping, to sudden or continued change of stress (even below the elastic limit), either of the same kind, as from one intensity to another, or of opposite kinds, as from tension to compression or the reverse.

Powdered coal constitutes 85% of the fuel used in calcining 93,500,000 barrels of cement made in America during 1917. This industry alone consumed 5,000,000 tons of powdered coal last year.

Chrome and Manganese in Cuba

*In order to utilize nearby sources of these essential minerals, it was decided to obtain authentic and detailed information as to the location, character, quantities, and availability of the reported chromite and manganese deposits in the West Indies. A beginning was accordingly made in Cuba by a party consisting of Albert Burch, of the U. S. Bureau of Mines, and Ernest F. Burchard, of the U. S. Geological Survey. This party left Washington, February 15, 1918. At Habana they were joined by E. I. Montoulie, a Cuban mining engineer, who was detailed by the Treasury Department of Cuba to act as escort and associate throughout the work on the island. George A. Wright, of Baracoa, Cuba, an American engineer familiar with the chromite deposits of the province of Oriente, was attached to the party from February 25 to March 20. The field work, which was completed late in April, included examinations of such reported deposits of chrome and manganese that seemed to be of promise, without regard to stage of development, and a determination of the quantity and quality of ore likely to become available for shipment within the next year and a half.

The engineering data and the tonnage, estimates in part, in the following brief reports on the chrome and manganese ores of Cuba are taken from an unpublished report made by Albert Burch to the director of the Bureau of Mines. All the analyses except two were made by R. C. Wells, of the U. S. Geological Survey.

The reserves of marketable chrome ore in Cuba range from 92,500 to 170,000 long tons, but only 2000 tons can probably be shipped in 1918, unless greater efforts to exploit it are made. The largest known deposits of chromite are in Cuba—those of the Caledonia, Cayoguan group, and Potosi claims—are near the north-east coast of Oriente, in a region difficult of access. They may yield 72,500 to possibly 130,000 tons, most of which can be brought to present commercial grade by simple concentration. With suitable transportation facilities and mining equipment and sufficient labor most of this ore could be mined and shipped within two years after these conditions had been established. At the time of the examination only one deposit was ready for production and on a small scale, but it seemed that the rate of production could be greatly increased by the employment of more miners and pack animals. It would require some time to put the other deposits in shape for production.

The next largest known group of deposits is near Camaguey. They are easy of access but are of lower grade than those in Oriente province. They appear to contain 20,000 to 40,000 tons of ore, most of which can be gathered by hand from the surface.

Near Matanzas, Cardenas, and Holguin there are small stocks of ore that are ready for shipment, perhaps 1000 tons in all. The ore near Holguin is of medium grade, but that near Matanzas and Cardenas is generally of lower grade. The expense of hauling the ore is reported to be almost prohibitive.

Despite the handicaps of climate, shortage of labor, and explosives, poor transportation facilities and marketing conditions, the operators of manganese mines are striving to increase their output, and there is a strong interest taken everywhere in Cuba in developing manganese prospects. If railway cars and ships are provided for transporting the ore, food for the mine laborers, and explosives for blasting, the outlook for a steadily increasing production in 1918 and 1919 is good. It is believed that the total output for 1918 should be between 110,000 and 125,000 tons, more than 90% of which will contain from 36 to 45% Mn, the remainder being of still higher grade. After the completion of a narrow-gauge track to certain important mines east of Cristo, in the Santiago district, in the summer of 1918, an increased output in 1919 is assured. The reserves of manganese ore in Oriente province are estimated at 700,000 to 800,000 tons, more than 85% of which are in the district north-east of Santiago.

*Abstract from U. S. Geological Survey Press Bulletin 380, Sept. 1918.

A Letter From the Front

A few days of rest and peaceful marching in a beautiful country, two memorable swims in a broad cool river in an amphitheatre of hills, villages, and small imitation chateaux, one supper in a near-by town with a few friends and a little wine, and the over-strained and one-sided frame of mind in which I last wrote to you has entirely disappeared. Life, I suppose, and the War and politics and social and personal relations are all precisely the same today as they were four weeks ago, but to me they seem entirely different. Everything seems silly and pretentious, and less worth taking seriously (except outwardly in order to get along and to avoid unnecessary trouble) now that I have seen how short a step it is from life to death and how brutally human beings shove each other across the line.

As a little automatic-rifle man from Alabama said to me one morning in a wood full of corpses: "I've got the inclination to go on. I ain't unwilling to die, if need be —but I do hope I can get through this, so as to tell about my experiences on the field of battle." I think he had in mind some vague scheme for influencing future generations in favor of Peace. Not, of course, that he pretended to any doubts of the necessity or justice of our present war, only his own point of view as to the seriousness of it had so changed that he felt posterity should be set straight on the point.

The corner of the woods where I was talking to this soldier was honey-combed with small holes, each big enough for two men and each at that moment tenanted by two dead Germans, the remnants of their last day's rations of black bread, their few books and small correspondence, and, except where our men had taken it, their machine-gun. The ground in front of them was not badly sprinkled with dead Americans with their helmets and packs on. The night before the little rifleman's regiment had taken the place, mainly with the bayonet. The young Alabaman spoke in the quiet disinterested tone of one who is convinced of the vanity of things.

I am usually fairly sensitive to natural beauty and as I recall the physical features of that wood, which had a creek running through it, I am sure that had I run across it last spring in a day off from my ambulance work I should have considered it a beautiful place. It was on a beautiful July morning that I visited it; however, I have absolutely no recollection of beauty in connection with the place. Literally a sort of blackness seems to surround each vivid picture of that wood as I recall it. It was my first sight of the reality of war, the irrevocableness of death, and the aspect of hands and faces set like waxwork in the expressions they had taken on yesterday, and would continue to wear as long as they were discernible.

My mission in the wood was not to chat with the Alabaman, but to locate the front lines of the regiment on his left, in order that its supporting artillery might know where to fire and where to avoid firing. I had hardly done half of my work, however, when a lieutenant who was showing me his platoon line received a message which he turned over to me with a shake of the head and a half-shudder. It was an order for an immediate advance. When I handed him back the paper he was shaking all over as if undergoing an intense chill. "The same stuff Alabama pulled," said he, and then, bravely and unconcernedly: "It's so damned cold out here I can hardly stand still." In fact, the sky had clouded and a cool drizzle was falling.

The next officers I met were a captain and a platoon commander; they greeted me cheerfully: "Just add four kilometres to your range, please," said the Captain. "We're moving-up—you fellows have done very good work in the past, you surely won't object to a little change like that." I went back and took my post, with the Major, for the advance, and began a walk of about two hours and a half through woods and over ridges where the Germans had left their heavy ammunition and some of their dead, but no living man to trouble us. The end of that time found us—the advance battalion—on a broad hillside overlooking a rich deserted valley and a silent village on the other side of a stream. The Major was planning for the reconnaissance of the village, which looked ominous, and on the outskirts of which some Boche artilleryman was quietly adjusting a piece. To "adjust" is to fire on a spot whose position on the map is accurately known, in order to find out the exact variation from normal of the particular lot of ammunition you are using. Just then we saw a pretty and welcome sight: a patrol of eight or ten French cavalrymen, lances and all, strung out to about fifty yards apart, trotting briskly down a road in the valley to our right toward the town. They rode on until the first horseman was on the bridge leading to the gates of the town. Then we heard a machine-gun, the first Frenchman fell from his horse, and the rest galloped off up the valley to our left.

A rocket went up from the town and burst, showing one green star, and in about three minutes the Boche artillery began laying a light barrage between us and the town, leaving us untouched on the hillside. In a few minutes, an agreeable looking French officer walked up to where the Major and the rest of us were lying flat in a wheat-field, saluted formally, standing very erect, and joined us. By this time the Boche machine-gunners in the town had identified the Major and his staff and were giving us periodical attention, to my great concern. The infantry, by the way, are much more thoroughly terrified by high-explosive shells than by machine-gun bullets, owing, I think, to the big noise they make and to the

hateful contortions into which they throw the bodies of those whom they hit. On the other hand, to me personally and to all other artillery-men with whom I have discussed the matter, machine-gun fire is much the more terrifying. We have a saving sense of the inaccuracies to which artillery is subject under the best conditions, we know that if one lies flat on the ground, or, better, in a depression, there is little chance of being hurt by anything less than a direct hit by the projectile itself, and the chances of such a direct hit are small. We know, moreover, that we can always hear the shell coming and tell whether it will land near us, and, if so, have plenty of time to flatten ourselves before it arrives. Machine-gun bullets, on the other hand, are not to be heard until they are actually passing, they always seem to pass between one's ear and shoulder, and they give one the unpleasant consciousness that before one has time to think another thought one may be irrevocably dead.

To return to the French cavalry officer: He reported to the Major calmly and in good English: "I cannot tell you where they all are, but I can tell you that one of their machine-guns is just across that bridge yonder, because one of my men was shot there." Another rocket went up from the town. This one burst into three white stars. A few minutes later the range of the Boche artillery began to lengthen and shells began falling among the forward elements of the battalion. At the same time I noticed something which, though much less dramatic than the high explosive fire, frightened me much more, namely, six or eight comparatively small explosions at intervals over our heads accompanied by puffs of white smoke in the air where the explosions were heard—in other words, shrapnel. Against troops in the open, shrapnel is far from being the kind of joke that high explosive shell may be. High explosive lands, partly burries itself, and explodes, throwing fragments up and out, so that the wise soldier, lying flat on his stomach, is in very little danger. Shrapnel, on the other hand, explodes in the air above the target and is so made that this explosion, like the explosion in the barrel of a shot-gun, drives forward and downward and scatters over the ground a large number of lead balls. Almost any kind of military shelter will stop these balls, but if you are in the open there is not much you can do to escape them, and a good artillery-man can thoroughly sprinkle considerable territory in a very short time.

When I saw the shrapnel bursting over our heads as we lay on that open hillside, I simply made up my mind to die, and I gritted my teeth and felt indescribably sick at heart at the prospect of seeing an entire battalion shot into debris. All the reasons I had for wanting to continue to live came back to me at once, and summarized themselves into a picture of a green lawn on a summer afternoon with the children playing in a sand-pile and mother handing me a glass of cool lemonade. Any reasons for disregarding the risk of death refused to come to mind and had to be dragged out—Wall Street, the law's delay, the rich man's contumely, the insufferable nuisance in daily life of keeping oneself respected by and on terms with a wrong-minded world, and provided with the necessities of a respectable existence. All these things, and the sweetness and propriety of dying for one's country, I rehearsed in a forced and artificial way. Finally, I stabilized myself to this point of view: whatever I may think of it, this thing must go ahead, and in all probability I must die or be severely wounded. I may just as well do it *avec un petit peu de chic* as in a shameful and demoralized way; it will mean the difference between making these hours, which in any event will very likely be the last of my life, quite tolerable and almost pleasant, by reason of a tickled vanity, instead of allowing them to be a hideous terror-stricken nightmare. In that frame of mind, substantially, I continued for the next three weeks. You will observe that my moral plane is much lower than that of any hero of fiction, patriotic speeches, or the newspapers, but, at least, I am describing it to you with absolute frankness. However, the business never did become pleasant. Toward the end I began to get used to it, and more indifferent than before, but there was never a time when I would have wished to prolong the War or my part in it for an unnecessary instant for the sake of the joy or glory of the thing.

As for the shrapnel-fire that first afternoon, it stopped after those first eight or ten bursts, which hurt no one. Either the Boche had no direct observation by artillery officers, and therefore could not adjust his shrapnel satisfactorily, or he thought the range too long for good work with that weapon. The fire with high-explosive shells, however, continued—the range always lengthening. I ventured to suggest to the Major that it might be safer to withdraw his battalion back of the nearest crest, so that the Boche might not have the satisfaction of seeing whether we were where they were shooting and might thus be discouraged from firing. He did so, but we were still troubled by shell-fire. On our left flank, some of our men who had pushed out a little way came within range of another village containing machine-guns, and one of them was killed. It was the first killing that I witnessed, and again I felt sick at heart. I watched the distracted way in which his comrades tried to pick him up by his arms and legs and take him back to our line and ran for a stretcher.

It was now getting dark. The Major gave the order for his men to dig in. The situation was stabilized for the night and I went to report it to my Colonel. I started back with a young private who had been slightly wounded in the arm by a small fragment. He was glad to be going back, and I will admit that I was, too.

COLD WEATHER, it was found by the United Eastern Mining Co. at Oatman, Arizona, decreased the rate of settling slime in the thickeners, and increased the time required for dissolving the gold by cyanide. A 75-hp. boiler was erected for heating the solutions, resulting in overcoming these difficulties. Mill-heating cost 1.5 cents per ton treated during 1917.

QUICKSILVER occurs in the richer silver ores of Cobalt. During its past financial year the Kerr Lake company produced 546 lb. of mercury, recovered from metallics.

The Ferro-Alloys

By J. W. RICHARDS

*Ferro-alloys are of great importance to the steel industry. The steel-maker uses them for two purposes: (1) As reagents to take oxygen out of melted steel and thus ensure sound solid castings (ferro-manganese, ferro-silicon, ferro-aluminum). (2) To put into the steel a proportion of the rare metal (ferro-manganese, ferro-chromium, ferro-tungsten, ferro-molybdenum, ferro-vanadium, ferro-titanium, ferro-uranium, ferro-boron). Melted steel, just before taking from the furnace, always contains some oxygen dissolved in it, like the dissolved gas in charged soda water. If this is not removed, the casting is unsound from cavities or blow-holes. The addition of a small amount of an element or metal with a high affinity for oxygen removes this element and makes the casting sound. Manganese in the proportion of 1% or less, is the cheapest and most generally used reagent for accomplishing this; silicon to the extent of ½% or less, is more powerful, but also more expensive, and is often used to supplement the action of manganese; aluminum, 0.1% or less, is still more powerful and still more expensive, and is used in very small quantities as a final addition to complete the action of the manganese and silicon.

The second use is to make special steels, that is, steels containing such quantities of the rare metal as give to them properties different from plain carbon steels deoxidized by manganese, silicon, or aluminum. Thus we may make manganese steel by putting in 12 to 14% of manganese, making a very tough hard steel, such as is used in mining and grinding machinery and burglar-proof vaults; 2 to 4% of chromium makes a very hard tool-steel; 15 to 25% of tungsten makes high-speed tool-steel, which cuts iron while red hot; 6 to 10% of molybdenum has powers similar to tungsten, and is also used in steel for lining large guns. Vanadium in quantities from $\frac{1}{10}$ to ½%, makes very strong steel which resists shock extremely well, as when used for automobile axles; titanium, uranium, and boron impart valuable properties not so easily described. Every one of these materials is used for producing some specific result which is not produced by any other. The value of these special steels to the industries, and particularly for military purposes, is very great, so great that the supply of ferro-alloys for their manufacture is an important factor in winning the War.

FERRO-MOLYBDENUM. Molybdenum has only recently come into large use in steel. Its action being somewhat similar to tungsten, scarcity of the latter metal, particularly in Europe, has led to the manufacture of ferro-molybdenum on a comparatively large scale. The ores are widely distributed, but not plentiful. The sulphide, molybdenite, used to be roasted to molybdenum oxide, and this reduced by carbon in the presence of iron ore or scrap-iron in an electric furnace. It is now smelted directly in the electric furnace with carbon and a large excess of lime along with iron ore or scrap-iron. Ferro, with 50 to 60% of molybdenum, is tapped from the furnace like other ferro-alloys, but with molybdenum up to 80% the alloy has such a high melting-point that it cannot be tapped without freezing; it is necessary to make a furnace full of this alloy; then let the furnace cool down and take it apart, taking out a large mass of solidified alloy; the furnace is then re-built. The large use of molybdenum in steel has been so recent that not much has been made public about it. Rumor says that the large German guns, the 'Black Berthas', which bombarded Liége, were lined with 6% of molybdenum steel to increase their resistance to erosion. It seems certain that Germany drew considerable supplies of molybdenite from Norway to compensate for shortage of tungsten for high-speed tool-steel. Parts of guns, gun-carriages, motors, automobiles, have also been made of molybdenum steel of most excellent quality. Canada has been especially active in the manufacture of ferro-molybdenum, most of which it exported to Europe. This alloy is therefore another pre-eminently valuable war material.

FERRO-VANADIUM. Without vanadium the modern automobile or auto-truck would be a much weaker machine. When steel is desired to withstand the heaviest shocks and vibration, nothing is so effective as vanadium. This is another comparatively rare metal, found principally in the radium ores of Colorado and as a black sulphide on the highlands of Peru. The canary yellow Colorado ore is treated for radium and the residues for vanadium and uranium. The U. S. government operates this process for the radium supply. The black ore of Peru is rich and unusual; it is a sulphide with some asphaltic matter, and it is roasted and brought into the condition of iron-vanadium oxide before reduction. The oxides are best reduced by metallic aluminum—vanadium oxide plus aluminum produces vanadium plus aluminum-oxide slag. This is the well-known 'thermit' (Goldschmidt) method of reduction. Electric-furnace reduction by carbon is not advantageous because of the large amount of carbon taken up by the alloy; powdered silicon is therefore put into the charge as the reducing agent, together with iron, lime, and fluorspar, and then a 30 to 40% vanadium alloy is obtained with seldom over 1% of carbon—a very desirable composition. Only small amounts of vanadium are necessary in improving the

*Abstract: Paper read at the National Exposition of Chemical Industries.

steel; 0.1 to 0.4% are the usual quantities. This is fortunate, because vanadium costs $5 per pound and over. Metallurgists suspect that part of the improvement of the steel may be due to the vanadium combining with and removing nitrogen dissolved in the melted steel. This is probably true, yet some advantage undoubtedly must be ascribed to the final vanadium content; steels thus treated are unusually resistant to shock and alternate stresses, making them useful for axles, cranks, piston-rods, and such severe service.

FERRO-TITANIUM. Titanium is an abundant element in nature. It occurs in immense amounts as a double oxide of titanium and iron, known as ilmenite, or titanic iron ore. This ore can be reduced directly by carbon in electric furnaces to ferro-titanium. The reduction proceeds easier if some aluminum is put in as a reducing agent, but this is expensive and unnecessary. The alloy, running 15 to 25% titanium, is sold for use in steel as a refining agent to remove oxygen and nitrogen. Thousands of tons of steel for rails have been treated thus, the tests showing considerable improvement in the mechanical properties by the use of small amounts (0.10 to 0.20%) of titanium. Only one firm in America makes this alloy, and its use in steel has not yet gained universal approval.

FERRO-BORON. This is an alloy whose valuable qualities have not yet been entirely determined. Boron is the metallic base of borax, which is a sodium-boron oxide. Borax is difficult to reduce. Another raw material, not so abundant, is colemanite, containing lime and boron oxide. Many attempts have been made, none very successfully, to reduce this with iron oxide to ferro-boron. The American Borax Co. offered a prize for several years for a process that would accomplish this. Boron oxide occurs rarely in nature, but it can be manufactured from borax and colemanite. When the oxide is obtained this can be combined with iron oxide and the resultant boron-iron compound reduced by carbon in the electric furnace to ferro-boron. Small quantities of this alloy have been manufactured. Experiments on steel have shown that ferro-boron acts somewhat similarly to ferro-vanadium. Experiments in France showed remarkably strong and tough steels were thus made, using 0.5 to 2% of boron.

The ferro-alloys are exceedingly important materials to the steel-maker. They are indispensable. They are important factors in producing both ordinary and fine steels, and therefore in winning the War. The country well supplied with them has a great advantage over the country in which they are scarce. They are deserving of all the expert attention which they are receiving from the War Industries Board, the steel-makers, and the economists. The possession by the United States of large supplies and resources for the ferro-alloys may be one of the important factors in determining the quick ending of the War.

INGOT-IRON can be annealed in an electric furnace to such a degree of softness as to permit of this metal being substituted for copper in many of the instances wherein copper is now employed on account of its available soft characteristics.

Electrostatic Precipitation

There are certain practical points connected with the operation of the Cottrell plants which I think should be discussed, although they are not so directly brought up by the author of the paper.

In the early days of the Cottrell apparatus, they treated moist fumes or gases carrying material that could be precipitated—sulphuric acid was the first. The treating of dry gases seemed to be a problem. Lately, we have been gathering information from various plants which indicates that a certain amount of moisture in the gases is necessary for good precipitation of the dust. At one plant, a relative humidification of 42% is considered the best proportion. This has been obtained by sprays of water from the roof of the flue leading to the Cottrell apparatus, and since those sprays were put in, the results have shown a wonderful improvement. At the plant of the International Smelting Co. at Miami, the concentrate treated in the roasters to which the apparatus is applied contain so much moisture that the gases naturally have the proper proportion, and the results at the plant are extremely good. When visiting a plant in the East not long ago, I noticed that the motor-generator set originally installed had been discarded, and a small synchronous motor had been put in to drive the rectifier. The superintendent explained that they took their power from a public service company, and had no trouble whatever from surges on the line, and no complaints at all from the power company since installing this synchronous motor, but that they had experienced no end of trouble in operating their Cottrell treater so long as they used a motor-generator set. I called the attention of some of the superintendents at our various plants that were using Cottrell treaters to this fact, but it only seemed to touch a sore spot with them; it seemed that there had been a great deal of discussion among the superintendents of the various plants, as well as the electrical experts, on this point. Some of those who had been instrumental in designing installations thought that the dangers from surges were so great that the use of synchronous motors was absolutely unsafe, and that the possible saving of a few dollars should not be considered at all in the installation of the Cottrell treater; that the main thing was to get the dust precipitated, and that a slight increase of efficiency in the electrical end of the apparatus was not worthy of consideration.

On my present trip I have found that the electrical expert in charge of the precipitation department in one of the plants has become fully convinced that the synchronous motor is the proper apparatus to install, and he demonstrated this to my untechnical eyes very clearly. They had four motor-generator sets on each side of the centre of the building, with transformers corresponding to each set. Four of these motor-generator sets had been re-wound, so that they were practically synchronous motors, and were driving the rectifiers.—E. P. Mathewson, at the Colorado meeting of A. I. M. E., September 1918.

RENO, NEVADA

Silver-Lead Mining.—The Con. Virginia.—Tungsten Mills.—Tonopah Divide.—Goldfield Consolidated.

Work has been resumed at the Groom mine and a 100-ton mill is to be erected on this once famous silver-lead producer in western Lincoln county. Many years ago the mine produced a considerable quantity of high-grade ore; the better grade was freighted over 100 miles to the nearest shipping point, and some ore was concentrated in jigs. Within the past five years production has been considerable, the ore being hauled by tractors to Indian Springs station on the L. V. & T. railroad, a distance of 65 miles. In most of the ore the principal content is lead, and the mine is said to contain a large tonnage carrying from 15 to 30% of that metal. The old main shaft is being unwatered and a new shaft is to be sunk. Salt Lake men are sinking a shaft in pay-ore a short distance south of the Groom mine, and seven miles north two Goldfield miners are working two groups of claims, on both of which they have exposed good ore. A small mill on one of these properties is to be enlarged. The district has abundant water and timber.

In the Con. Virginia mine at Virginia City new ground is being explored on the 2100-ft. level. The west cross-cut, reported to be showing some good ore, is in a vein described by Whitman Symmes, the superintendent, as being farther west than any of the veins developed on deep levels and apparently not drained by any of the other workings. Mr. Symmes also reports a favorable showing in the roof of the north drift on the 2200-ft. level. Ore sent to the mill from the Con. Virginia mine in October has averaged $17 per ton, as against an average of $14.84 in September. Other mines of the Comstock have made a normal production from the usual footage of development.——Two tungsten mills are being erected near Sodaville, in Mineral county, and a third is in prospect for the same district. Joseph Bean, William Noonan, and L. E. Beck are building one of these mills to treat ore from a lease they have been working on the property owned and formerly operated by Atkins, Kroll & Co. This lease has produced some high-grade scheelite, one carload having yielded a net return of $9000, according to the lessees, who claim to have blocked a substantial tonnage of mill-grade ore. The higher-grade product has been shipped to reduction works in Humboldt county, Nevada. Parties from Wheeling, West Virginia, who have had mining interests in this region for many years, have acquired ground adjoining the Atkins-Kroll group and, working from a 200-ft. shaft, have exposed a large tonnage of pay-ore. They are building a 60-ton plant to treat this product. In the same district scheelite has been found at a number of places on the property of the Berndy Tungsten Mines Co.——Raymond T. Baker, director of the Mint, has arrived at Reno to remain until after the general election. His arrival was delayed by an attack of influenza, from which he has quite recovered, and he was compelled to postpone the meeting of mint superintendents and Government assayers, which he had called for October 15 at Carson City. Mr. Baker says this meeting will not be held until the epidemic has disappeared. His object in calling the meeting is to bring about betterments in the service that will benefit the mining industry, but there is no intention of resuming coinage of the metals at the Carson mint.——Silver-gold ore is being shipped from the Tonopah Divide mine, six miles south of Tonopah, to the Goldfield Consolidated mill at Goldfield at the rate of 200 tons weekly and the output will be increased to a 60-ton carload daily; sufficient to pay for development and provide a surplus for mill or railroad construction within a year. An auxiliary hoist has been installed at the 370-ft. level and the shaft will be sunk to water-level, estimated to be below 700 ft. Drifts on the 160, 265, and 370-ft. levels are being extended on the lode while cross-cuts and raises are being driven at 50-ft. intervals to block the ore on these levels. No stoping has been done and the ore-dump at the shaft is said to contain 6000 tons of $30 ore. A cross-cut on the 260-ft. level is being driven south to cut the vein that yielded high-grade gold ore at the surface, higher on the mountain. Medium-grade ore has been found on the 295-ft. level of the Gold Zone property, adjoining the Divide mine on the east. The find was made in driving near the Divide end-line. The East Divide Co. has installed a complete electrically-driven surface plant, including a compressor and air-drills, and is sinking on the Merced claim, just east of the Gold Zone, at a point where the vein-croppings gave assays up to $5 gold. The shaft is down 70 ft. and has been in soft ground, broken easily by pick and hand-drill. The first lateral work will be at the 300-ft. level. The Brougher Divide has installed electric machinery and will deepen its shaft.——At Goldfield the mill of the Consolidated Mines Co. is treating 700 tons of mill-tailing daily, in addition to some low-grade mine and dump ore and the product of the Tonopah Divide mine. The pits opened in the tailing pond by the big grab-bucket of the Lidgerwood cableway are at a depth where some of the higher-grade tailing is now being handled. Lessees working from the Gold Bar shaft of the C. O. D. Consolidated have shipped several carloads of good ore, exposed at depths of 150 and 200 ft. in extending old workings. Wide faces of

PART OF GOLDFIELD

good mill-ore have been exposed at a number of points down to the 400-ft. level. The C. O. D. embraces the extension of veins that have yielded good ore on the adjoining Florence, Atlanta, and Consolidated properties. Development work has been started on the 600-ft. level of the Red Hill Florence, which continues shipping ore of good grade from six faces on the 400 and 500-ft. levels. The shaft has been re-timbered to the 600-ft. level, where the station was enlarged and heavily timbered for the work now in progress. The shaft of the Silver Pick Con. will be sunk at once another 50 ft. from the 1260-ft. point, in order to better explore the zone just penetrated, where molybdenum has been found, together with quartz yielding encouraging assays in gold and silver. The Great Bend mine is reported by J. K. Turner, consulting engineer, to be in better condition than for some time past, with stopes on the 160-ft. level producing ore of shipping grade and the new raise from the 370-ft. level entering the first of the series of ore-shoots developed at the 260-ft. level. A large tonnage of good mill-ore has been exposed in developing the higher-grade deposits and tests have been made lately with a view to remodeling the company's small mill and treating this ore. In the Atlanta mine a raise from the 1850-ft. level is following the foot-wall near the point where the shale forms the wall, and wide seams of good ore have been found. The Blue Bull is breaking high-grade ore from a narrow vein opened in a raise from the 250-ft. level. The shaft of the Grandma Consolidated was sunk 830 ft., well within the shale, and has been equipped for extended development. The sump cross-cut, driven west 100 ft., exposed some $14 ore in the contact-zone. Drifts are being advanced north and south at 805 ft., on the shale. H. G. McMahon, secretary and manager for the Cracker Jack company, has returned to Goldfield from New York and may decide to resume work on that property, in which ore of good grade was exposed at a depth of 300 ft. The Spearhead company will continue its development work, according to A. A. Codd, secretary. It was feared that the labor shortage and depleted funds would necessitate a suspension of work. The Merger Mines Co. is not working but is awaiting the results of development at depth in the adjoining Atlanta. Mr. D'Arcy, manager of the Kewanas, has only a small force at work in the southern area, but reports encouraging results from his more recent work. The Silvermines Corporation has suspended work for the present at Hornsilver, 26 miles south of Goldfield. The new 150-ton mill made a satisfactory extraction, but the ore is too low-grade to yield a profit under present conditions.

TUCSON, ARIZONA

Arizona Tax Commission and the Standard Oil Co.

The attack made by the Standard Oil Company on the system of valuation employed by the Arizona Tax Commission by means of an injunction suit filed in the United States District Court at Tucson is likely to re-open the whole question of corporate taxation, including that of the mines, if the plaintiff should be successful. As taxes on producing mines are the principal source of revenue to the State and as the amount paid by the mining companies reaches the millions, the litigation is of far-reaching importance. The assessed valuation of Arizona mines for 1918 was recently announced by the Tax Commission as a slight advance over the 1917 figures, which were $393,421,536, which is 56% of the gross valuation. This is an increase of 87.3% since Arizona became a State. Together with the railroads, the mines share in the payment of about two-thirds of the State's revenue. The taxing of railroads is done under a special statute, on the basis of valuation per mile, so that they will not be affected by the outcome of the suit. The mining companies have long been dissatisfied with the regulations under which their assessments have been figured by the Commission and repeated attempts to secure enactment by the legislature of a mine-taxation law have been made without success. The system applied to the Standard Oil Co. this year for the first time is similar to that developed to reach the mines and first applied to the latter, and subsequently to other business. The assessed valuation of the property of the Standard Oil Co. in all counties of the State was $342,646, and it was upon this valuation that it was taxed in 1917. The system employed by the commission this year, when it sat as a board of equalization, was to capitalize the company's net profits, calculated at $727,649 on an assumed basis of 25%, thus arriving at a valuation for assessment purposes of $2,910,597. The net income of producing mines is capitalized at 15%. The complaint attacks the action of the Commission on constitutional grounds, Federal and State. The company considers that the effect of the Commission's order to tax the income of the company's wells, refineries, and manufacturies in California as the profits they have used as a basis of valuation are proceeds from this property and not from Arizona agencies.

CRIPPLE CREEK, COLORADO

Vindicator Con.—Ferro-Alloys.—Strike on the Deadwood.

The quarterly report of the Vindicator Consolidated Gold Mining Co., mailed stockholders with the dividend of 1 cent per share, payable October 25, amounting to $15,000, shows a reserve on hand of $225,000, and net earnings for the third quarter of 1018 of $95,000. G. S. Wood, the president, further announced that the "results of development work during the past two years have impressed the directors with the need of acquiring additional property with which to extend the operations of the company" and announces the acquisition of the plant of the Ferro Alloy company of Denver together with a lease and option on a chrome property near Glenrock, Wyoming. The basis of the purchase was the liquidation of the debts of the Ferro Alloy company amounting to $100,411, which amount was more than covered by the liquid assets of the company, and a further payment to the stockholders of the amount of their investment, together with 6% interest, which is to be paid from profits of operating of the plant of the Ferro Alloy company. The price paid for the lease and option amounted to $12,743. Additional machinery to double the capacity of the plant is estimated at $25,000 and the installation has been authorized, with the expenditure of $20,000 for development of the chrome deposit. Ample supplies of manganese, tungsten, silicon, uranium, and vanadium are reported "available in Colorado and adjacent States for the manufacture of the ferro-alloys of those metals." The Ferro Alloy, it is reported, had been operating at a moderate profit, but found operations curtailed by lack of capital; hence the sale. The plant of the company is at Denver.——The Cresson Consolidated Gold Mining & Milling Co. will pay the regular monthly dividend of 10c. per share, $122,000, on November 10.——The Golden Cycle M. & R. Co. will pay the regular monthly dividend of 3c. per share, $45,000, on the same date. A. E. Carlton of this city and Colorado Springs is president of both corporations.——The Strong mine, near Victor, with a production record in excess of $10,000,000 from its 7½ acres, will close-down at the end of October, and for the duration of the War. The labor shortage and enhanced operating costs are the reasons for the shut-down. The Strong Gold Mining Co. is a close corporation controlled by Colorado Springs capitalists.——A rich strike has been made at shallow depth, 55 ft., on the Deadwood claim of the United Gold Mines Co. on Bull hill. The strike was made in the long abandoned Williams shaft, by the Deadwood leasing company, whose stockholders are Denver and district operators. The superintendent, Sam Stumpff, an old

district miner, has opened up five feet of shipping-ore, carrying an 8 to 12-in. core that assays as high as 3 oz. gold or $640 per ton. The initial shipment to leave the mine this week is estimated at 5 oz. ore.——The Big Toad G. M. Co. operating the Dante mine under lease is exploiting the claim from the 600-ft. level of the main shaft by diamond-drill. The drilling commenced this week and is being watched closely by those controlling adjacent property.——M. Chagneau of Paris, France, representing the French National Defense league, is this week examining the potash deposits near Hartsel in Park county, Colorado, about 30 miles west of Cripple Creek. The property is owned by Mrs. E. R. Ashe of Denver.——Four Japanese mining men, S. Shinosaki from New York, U. S. manager of the Furukawa company, Richachiro Kanoko, chief accountant, and Yuichi Sato, mining engineer of the same company, and Keli Nako, chief electrical engineer of the Ashio mine, visited the district during the past week. The Japanese are visiting the mining districts of Colorado and the West with a view to introducing new methods and machinery in their native land.

VICTORIA, BRITISH COLUMBIA

Smelting Charges.—Sampling-Plant.—International Mining Convention.

After marking time for several months, a definite announcement has been made as to plans of the committee appointed by the Associated Boards of Trade of eastern British Columbia to conduct an investigation into the matter of the treatment charges of the Consolidated M. & S. Co. at Trail. The first session was held at Nelson on October 31 and was called "to receive evidence from shippers of ore to Trail."

At a meeting of the Vancouver Chamber of Mines held recently, the Hon. Martin Burrell, Minister of Mines, stated that an ore-sampling plant would be established in this Province by the Dominion government.

An international mining convention will be held at Vancouver from January 8 to 10, 1919, inclusive. It will be conducted under the auspices of the Vancouver Chamber of Mines, the officials of which body propose bringing some of the most prominent mining men of the continent to this Province to participate in the proceedings.

The West Kootenay Power & Light Co. has ordered 800,000 lb. of copper cable and other material from manufacturers at Hamilton, Ontario. This is sufficient for 300 miles of line and will be used chiefly in extending the circuit from Greenwood to Copper Mountain, to supply power for the B. C. Copper Mining Co. at that point.

DURANGO, COLORADO

Gold King Extension

As a result of efficient work under the management of W. Z. Kinney, the Gold King Extension Mines Co. will be added to the list of shippers from the district long before the scheduled date. If climatic conditions are favorable, with a long open season, a large tonnage will be shipped before the close of the year. The mill will be running by November 1. Considering the shortage of labor, the reopening of the Gold King within such a short period is quite an achievement, as those acquainted with the difficulties peculiar to operating in the Gladstone district were of the opinion that it would not be possible for the new company to begin production before next season. A force of 50 men is employed at the present time, at both mine and mill, and as the mill speeds up to normal capacity—500 tons of concentrates per month—the force will be increased. The Gold King ships an iron-copper sulphide ore, carrying gold and silver, and frequently pockets of exceptionally high-grade ore are found. Operations have always been on an extensive scale, and exert a decided influence on the property of the district. It is indicative of the marked interest being shown by outside capital in the Silverton district that the Cocomongo Mines Co., of Toledo, Ohio, now operating mines at Bonanza, is investigating a mine near Silverton.——The Mears & Wilfley tailing plant will probably continue to operate until the close of November, labor conditions having improved, and the recovery during the past season having been gratifying. At the present time the plant is shipping concentrate at the rate of 800 tons per month.——Ray Crawford is leasing on the Champion, and will install a small air-compressor, a motor, and a Leadville hoist.——A 310-ft. raise is being driven from the Koehler tunnel to the Carbon workings, on the Summit Copper property, in the Red Mountain district.——Considerable interest is being shown in the Stony Pass mining district.——Near Animas

Forks, A. W. Johnson is doing some preliminary work on the Columbus mine. Good headway is being made on a cross-cut tunnel that is to cut a lead vein. In addition to developing the Columbus, Mr. Johnson expects to ship ore from the Mountain Queen at an early date.——At Telluride, the Lewis Mining & Leasing Co. closed down for the season on September 30. Shortage of labor and the high cost of operating are given as the cause. Eighty-one cars of ore were shipped from the Telluride district during September. The Little Annie, Golden Gate, and Lucky Three Lodes have been patented by Oscar Bengston.——At Ouray, the Ouray Consolidated Mining & Reduction Co. has been developing the Guadeloupe property; in the breast of the north drift a three-foot vein of bornite copper ore has been opened. A car-load is ready for shipment, and from now on five tons per day will be pulled.——At Rico the shortage of labor has been somewhat relieved, and increased activity is being shown in all of the leading properties. The exploitation of sulphur and alunite deposits is receiving attention. The Marmatite Mining & Milling Co. is extending its holdings; in addition to leasing the Silver Swan, the Pro Patria mine, mill, and tramway have been taken under control, and a force of men is engaged in opening up the entire length of the Enterprize vein. A number of leases have been secured on the Syndicate Mining & Milling Co.'s holdings. The most interesting development is the formation of a company of large resources, directed by Bulkeley Wells, to open up the alunite-potash deposits on Calico peak. During winter exploratory work will be done to determine the depth of the deposits, and if indications warrant it, a large mill with a capacity of 200 tons per day will be built. Phil Flynn has been appointed superintendent.——Marked interest is now being shown in the sulphur beds near Dunton. There is a report that the Government may undertake the development of some of these deposits.

ARIZONA

Tucson.—William Howard Taft, former president of the United States, has been appointed special master by Judge W. H. Sawtelle of the U. S. District Court at Tucson in the case of Allan Forbes of Boston and George D. Morris of Prescott, receivers for the Gila Copper Sulphide Co., against the American Smelting & Refining Co. The Gila company is asking a permanent injunction against the Hayden smelter restraining them from refusing to handle ores from the Christmas mine according to contract. The temporary injunction granted in July is continued during the pendency of the hearing. The smelter wants a change in the contract on account of differences in the ore-treatment rate occasioned by abnormal conditions due to the War. The American Smelting & Refining Co. operates the Christmas mine, but does so under a contract as agents for the Gila company.

COLORADO

Lake City.—There is a growing interest in the Lake City field, and work is being carried on by a number of claim-holders. One of the main handicaps to development is a lack of capital.

The old Ulay shaft is being pumped out preparatory to development; as the water subsides, timber that has been submerged for 30 years is revealed.

Ouray.—The Ouray Con. M. & D. Co. is milling Treasury Tunnel ore and recently shipped a car of good concentrate. The main driving gear at the Treasury Tunnel mill broke and stopped operations for several days; steel gear is to replace the machine.

The holdings of the Gold Crown M. & R. Co. have been foreclosed to satisfy a judgment in favor of the John Frickice Lumber Company.

Rico.—The Marmatite M. & M. Co. is shipping heavily. The company has purchased a building in the city to be used as a boarding-house and club for a large force of miners. Recently a lease was secured on the Silver Swan, and a few men are now engaged in development on this property.

The Rico Wellington company has almost completed its drift to the Leap Year fissure, and a large quantity of good copper ore is being opened. Shipments averaged 50 tons per month. Now that the men are released from tunnel work it is expected that a large tonnage will be shipped.

The Milwaukee Gold Mining Co. has been declared defunct.

Silverton.—The Sunnyside M. & M. Co. is employing 300 men. A new boarding-house has been completed, and is considered one of the best appointed and comfortable in the State. The policy of the Sunnyside is to make the camp as agreeable as possible to miners, thereby attracting steady and high-class workers.

The Henrietta Copper Mines Co. shipped its first car of ore late in September. The ore assays high in copper, and carries good value in gold and silver. Prospects are encouraging.

The Mears & Wilfley plant will probably close down earlier than usual this year owing to the difficulty in securing labor.

J. T. Terry is extending his holdings in the Eureka district, and has acquired the properties of the Sunlight M. & M. Co., and of the California Mountain Mining Company.

Telluride.—The Lewis Mining & Leasing Co. may be compelled to shut-down on account of the shortage of labor.

The Cimmaron mine, under lease to the Wagners, is being extensively developed. At present the operators are getting out a dry gold-iron sulphide. Plans are now being made to develop the lower tunnel of the Bradley claim, where recent examination shows good lead and zinc ore. Samples assayed over 12% zinc, from which a 40% concentrate can be made. The Cimmaron mill is prepared to dress 150 tons of this ore daily.

KANSAS

Baxter Springs.—The Constitutional Lead & Zinc Mining Co. has its flotation plant in operation at the Midas mill, six miles south-west of this place. This system is known as the 'Buchart' and is successful in saving the extremely fine mineral which could not be done by ordinary methods of concentration. W. P. Eberlein of Joplin, superintendent of the Constitutional, states that the system is the greatest saving device that can be installed, and in time a majority of the new plants probably will be equipped with such apparatus. In an ordinary mill making 10 tons of concentrate per day an additional ton can easily be made by using the 'Buchart' system with the flotation plant. The additional expense for oil, chemicals, and power is small.

Kendall.—Barnes-King Development pays 10c. per share on November 15. This is equal to $40,000. The mines yielded gold worth $48,442 from 7120 tons during September.

Waco.—The High Five Mining Co., owned by Webb City men, is building a 300-ton (in 10 hours) mill. Drilling in 17 holes cut good ore at depths of 135 to 250 ft. Two shafts have been sunk. A Pomona pump, driven by a 100-hp. Nordberg oil-engine, takes care of the water. The owner of the land gets a 10% royalty from the lessees.

MONTANA

Ennis.—J. H. Pankey, manager of the Missouri and McKee mines on South Meadow creek, Madison county, has the 10-stamp mill, cyanide tanks, and aerial tramway nearly ready for operations.——The parties that have been operating manganese properties, 12 to 16 miles south of here, have discontinued hauling by their pneumatic two-ton trucks, four of them, and are now hauling wheat 18 to 20 miles at Norris for $8 per ton. The manganese occurred in narrow seams—streaks and pockets—of high grade, but not enough of it.—An asbestos property is being developed about 40 miles south of here.

The Winnetka property, four miles up Alder gulch from Virginia City, is running its concentrating mill continuously and making regular shipments of concentrate. It is reported that recently the company had found new bodies of good-grade ore. Harry Hall is manager.——The Metcalf mine, at the head of Barton gulch, has discontinued milling owing to inability to secure teams to haul the ore. W. O. Thompson is the owner.——The Highland Chief mine, four miles west of Virginia City, is being examined under an option to purchase after the water is pumped out. E. A.

Smith, of Whitehall, is the owner.——The Ruhl mine, three miles east of Sheridan, recently shipped a $1300 gold bar from two weeks clean-up of the 5-stamp mill.——The Lake Shore property, up Wisconsin creek, is putting in a new filter, in connection with its cyanide process. Several kinds of treatment have been tried out on this property.

TEXAS

Terlingua.—Development of a new quicksilver district, 40 miles east of here and 75 miles from the nearest railroad, is in progress. Rich cinnabar was discovered in that locality three years ago, but for some reason there was a delay in beginning work. It is stated that the Ellis Quicksilver Co. is now extracting considerable quantities of ore, and that the owners of other claims propose to put in machinery.

In the Terlingua district, an increase of quicksilver mining is noted. The producing area has been extended by the Study Butte Mining Co., which is developing a good property five miles east of here. The company is now erecting a new power-plant and oil-engine. Two miles farther east of the Study Butte is a large outcrop of cinnabar that is being mined by open-cut, by the Mariposa Mining Company.

WASHINGTON

Chewelah.—As more men become available, and the power supply has been increased to 600 hp., the United Copper company is to produce 900 tons of ore and concentrate in October, against 330 tons in the previous four months.

CANADA

British Columbia

Anyox.—Granby Consolidated produced 3,371,535 lb. of copper during September. Of this, 2,682,996 lb. was from the Anyox property. The Grand Forks plant yielded 288,539 lb., against 393,894 lb. in August, 672,289 lb. in July, and 889,140 lb. in June.

Revelstoke.—The Woolsey claims on Silver creek, a short distance from here, have been bonded by Calgary, Alberta, men for a substantial sum. The ore carries silver and lead, and is said to be high-grade. A road is to be constructed to replace the present trail to the mines, and a bridge to connect with the latter is promised over the Illecillewaet river.

Rossland.—One of the most striking illustrations in British Columbia of the effect of the gold situation is visible here. The mines of the Consolidated M. & S. Co. have been practically closed. There has been no ore shipped for some months, although work is being carried on in the principal mines of the district with small forces. Those employed, however, are engaged only in development. About 200 miners are working in the Le Roi, Centre Star, and War Eagle, while 80 are employed in the Josie, all of which are the Consolidated company's mines. On the Velvet, 9 miles from Rossland, owned by the Granby company, there are 50 men. The people of Rossland are not discouraged.

Silverton.—The Echo Silver-Lead company is said to have arranged for a lease of the Standard Silver-Lead company's mill during part of each month. A 4000-ft. aerial tram is being erected to connect with the Silverton tram. E. J. Burns and L. J. McAtee of Spokane are largely interested.

Manitoba

Development of the copper region north of The Pas, Manitoba, may be considerably hastened by the present urgent demand for the metal. The Mandy mine at Schist Lake, owned by the Tonopah Mining Co. of Nevada, has high-grade ore, making it profitable to mine and ship in spite of transportation difficulties. The more extensive deposits of the Flin Flon, estimated at 25,000,000 tons of $10 ore, of considerably lower grade, are not being worked, railway connection being regarded as a necessary preliminary step. A smelter will have to be built near the mine at a cost estimated at $4,000,000 or more. The Hon. Edward Brown, provincial treasurer of Manitoba, has announced that a railroad will shortly be constructed to the copper region, and will connect with the new Hudson Bay railway, 70 miles distant, at a cost of $2,000,000. Many construction projects are being held over until the close of the War, but owing to the need for copper this is regarded as essential work, demanding speedy action.

Quebec

Thetford.—The chrome industry in this Province is looked upon as of minor importance, and that importance entirely due to the War. A great many prospects and mines were opened during the early war boom, but those remaining are only three, where a fairly persistent supply is secured. They are, the Dominion Mines & Quarries at Lake St. Francis, the Reid Estate at Lake Caribou, and the Quebec Asbestos & Chrome Co., near Danville. The first of these ships its ore in crude form; the second is entirely a milling ore; while the third yields 40 to 45%, 15%, and 30 to 35% ore. Concentration of the ore has never received great consideration for the reason that the supply was always so doubtful that it alone appeared to be vital. The only scientific work so far has been done by the Mutual Chemical Co. at its two mills, Lake St. Francis and Black Lake. The result of this work marked no progress, however, as they at once faced a problem for which they could offer no solution, namely, the concentrate was clean and carried upward of 50% Cr_2O_3, but this 50% was made-up of 6 to 8% Al_2O_3, which vitiated the product for their particular use.

Vancouver Island

Victoria.—Development on a fairly large scale continues at the Old Sport copper property, which has been under bond to the Consolidated M. & S. Co. since September 1916, on Elk lake near Quatsino sound. Diamond-drilling results have been satisfactory, and it is expected that it will not be long before the company will commence shipping. The ore carries between 1.4 and 4% copper. A water-power plant has been developed from Canyon creek, supplying 50 hp. at present with a 350-ft. head; but 425 hp. can be developed at low water. The flume is 8000 ft. long to a 900-ft. pipe-line. A two-drill compressor-plant, electric-light plant, compressed-air friction-hoist, Cameron sinking-pump, etc., are at work. William Clancy is mine superintendent.

Another promising Vancouver Island property, which is attracting considerable attention, is the Sunlock claims, on the Jordan river, 42 miles by motor-road from Victoria. Extensive development is being carried out under the supervision of R. H. Stewart, formerly with the Consolidated M. & S. Co. Results are highly encouraging, and the mine is predicted to become a large producer. W. M. Brewer, District Engineer, inspected the property last year. Four tunnels have exposed three distinct ore-zones, as well as extensive surface stripping across another, known as the centre zone, where three open-cuts have been made on apparently three seperate mineralized zones at elevations between 780 and 865 ft. Each cut is 20 ft. long across an orebody. It is a low-grade copper property, samples assaying between 1.2 and 2.7%, some showing gold and silver valued at 50c. per ton. A wagon-road has been constructed this year a distance of 6000 feet.

Rich silver ore has been opened in six properties in a mineral belt known as 'Lightning Peak', near Edgedoow, on the west side of the Arrow lakes, 100 miles from Revelstoke.

Yukon

Dawson.—Navigation on the Yukon river closed for the winter on October 22. A mail launch arriving from White Horse, ran the last 50 miles through floating ice. More than 400 outbound Alaskans left White Horse for Skagway and the 'outside'. This is believed the largest number ever leaving in the Yukon valley in one day.

Mining Decisions

Mining Machinery—Removal by Lessee

Where a mining lease gave the lessee the right to remove his machinery at the termination of the lease, and it was left on the ground and extensively repaired by the lessor for a period of six months from and after the cancellation of the lease, the lessee and his creditors were held to have forfeited their interest therein.

Heim v. Brock (Arkansas), 202 Southwestern, 36.

Mineral Rights—Adverse Possession

Where the ownership of minerals underlying land has been separated by a conveyance from that of the surface, possession of the surface does not necessarily carry with it possession of the underlying minerals. The mining of coal by a grantee of the surface of the land, although for such time as to give him title to the coal in place by adverse possession, did not give him title to oil and gas deposits not then known to exist as against a prior grantee of the mineral rights in the land.

Kentucky Block Cannel Coal Co. v. Sewell (Kentucky), 249 Federal, 840.

Sale of Coal Rights—What Conveyed

A purchaser by general warranty deed of all the coal under the grantor's land, waiving the right of surface support and containing no time limit within which the coal must be removed, is entitled to use the gangways made in removing the coal for the transportation of coal from other lands adjoining the first grantor's farm, even though several years elapsed between the final removal of all coal from beneath the grantor's land except the pillars supporting the surface.

Westerman v. Pennsylvania Salt Mfg. Co. (Pennsylvania), 103 Atlantic, 539.

Depositing Debris on Land—Damages

In an action for injury to land by deposit of water, muck, and rock from an ore-washer, testimony detailing the injuries to the land and stating its value before and after the injury was done, is admissible. The jury is then left to infer the damages to be assessed. If the jury found that plaintiff's land was damaged solely by the acts of defendant in depositing thereon such water, muck, and rock from defendant's ore-washer, then the defendant was properly held responsible for the whole of the damages.

Tennessee Coal, Iron & R. Co. v. Bunn (Alabama), 79 Southern, 360. June 20, 1918.

Coal Lease—Forfeiture—Waiver

Where defendant in violation of the terms of a lease made no bona fide effort for five years to mine coal on land leased from plaintiff, there was such an abandonment as would entitle the lessors to cancel the lease. Where, however, instead of commencing a suit for immediate cancellation, the lessors wrote the lessee urging him to sell his rights thereunder so as to enable development to take place, and merely threatened to sue for a cancellation, and immediately upon receipt of said letter the lessee entered into operating arrangements and proceeded to develop the mine, the lessors were held to have waived their right to claim a forfeiture, and suit for the same filed after the lessee and his associates had expended large sums in placing machinery on the ground and commencing operations in good faith, was denied.

Schmidt-Blakely Coal Co. v. Hembree (Arkansas), 205 Southwestern, 111. July 1, 1918.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Philip Argall was recently at Rico, Colorado.

Philip N. Moore has returned from Washington to St. Louis.

F. LeRoi Thurmond has been examining mines near Broad Pass, Alaska.

D. M. Riordan has returned to San Francisco from Hanover, New Mexico.

Henry D. G. Reynolds has returned to New York from the Altai region of Siberia.

Robert Hay Anderson, of Mexico City, is at the St. Francis hotel, on a short holiday.

T. Skewes Saunders, manager of the Dos Estrellas, has returned from London and Paris to El Oro, Mexico.

Stanly A. Easton and **Louis S. Cates** have been nominated directors of the American Institute of Mining Engineers.

Andrew C. Lawson, Professor of Geology in the University of California, is on his way to France to serve with the Red Cross.

Edwin J. Collins of Duluth has finished some examination work near Tonopah, Nevada, and is now near Saltese, Montana.

E. P. Crawford, of Silver City, New Mexico, has been commissioned First Lieutenant in the 428th Engineers and is now at Camp Cody.

It is stated officially that **H. A. Guess** is **not** to replace **C. B. Lakenan** at the Nevada Consolidated and Mr. Lakenan is **not** going to Chile.

George B. Wilcox, formerly chief watchman for the Calumet & Arizona company, is now Major in the Army and is stationed at Camp Greene, North Carolina.

Sidney J. Jennings, President of the Institute, is expected in San Francisco about November 13 and if the influenza regulations do not interfere he will deliver an address before the Local Section of the Institute on that date.

Winthrop R. Cady, sales manager of the Colorado Iron Works Co., died at Salt Lake City on October 25 of pneumonia following influenza, aged 31. Mr. Cady had a record of 17 years' continuous service with the Colorado Iron Works Co., and had a wide acquaintance among the metallurgists and mining men of the West.

Clarence S. Verrill, **C. E. Watson**, and **G. C. Randolph**, the two last representing the Mining Corporation of Canada, were lost when the 'Princess Sophia' sank near Skagway, Alaska, on October 25. They were returning after having examined the Engineer mine at Atlin, B. C., the owner of which, **Capt. James Alexander**, was also lost, with his wife.

Howard S. Lee died of influenza at Silverton, Colorado, on October 25. He was widely known throughout the West as a mining engineer of marked ability. He was the son of Mrs. D. K. Lee of 1763 Williams St., Denver, and was born at Golden, 38 years ago. He attended East Denver High School, Dr. Holbrook's Military Academy at Ossining, New York, and finished his education at Stanford University, where he was prominent in athletics. Ten years ago he became associated with the United States Mining, Smelting & Refining Co. and has managed several properties for that company. Until recently he was general manager of the Leadville unit, the unwatering project undertaken on Fryer hill by the United States company three years ago. He had recently been promoted to the position of assistant to the chief consulting engineer and expected to leave soon for his headquarters at San Francisco.

THE METAL MARKET

METAL PRICES

San Francisco, November 4

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	15
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11.50
Zinc-dust, cents per pound	15

ORE PRICES

November 4

Chrome, no definite quotations available.	
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.25
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$26

EASTERN METAL MARKET

(By wire from New York)

November 4.—Copper is unchanged. Lead remained unaltered all week. Spelter is quiet and steady.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 48.81 pence for metal 925 fine.

Date	New York,	London	Average week ending	
Oct. 30	101.12	48.81	Sept. 24	101.12
" 31	101.12	48.81	Oct. 1	101.12
Nov. 1	101.12	48.81	" 8	101.13
" 2	101.12	48.81	" 15	101.12
" 3 Sunday			" 22	101.12
" 4	101.12	48.81	" 29	101.12
" 5 Holiday			Nov. 4	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date		Average week ending	
Oct. 30	26.00	Sept. 24	26.00
" 31	26.00	Oct. 1	26.00
Nov. 1	26.00	" 8	26.00
" 2	26.00	" 15	26.00
" 3 Sunday		" 22	26.00
" 4	26.00	" 29	26.00
" 5 Holiday		Nov. 4	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.69	23.50	Nov.	31.95	23.50	. . .
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Oct. 30	8.95	Sept. 24	9.76
" 31	8.95	Oct. 1	9.55
Nov. 1	8.95	" 8	9.31
" 2	8.95	" 15	9.02
" 3 Sunday		" 22	9.08
" 4	9.00	" 29	9.04
" 5 Holiday		Nov. 4	8.96

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
Oct. 30	8.05	Sept. 24	8.05
" 31	8.05	Oct. 1	8.05
Nov. 1	8.05	" 8	8.05
" 2	8.05	" 15	8.05
" 3 Sunday		" 22	8.05
" 4	8.05	" 29	8.05
" 5 Holiday		Nov. 4	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefore $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
Oct. 8	120.00	Oct. 22	120.00
" 15	120.00	" 29	120.00
		Nov. 4	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110 0	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61 54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62 24	78.82
May	49.10	63.21	100 01	Nov.	44.12	74.18	....
June	42.07	61.93	91 00	Dec.	42.55	85.00	....

ORES (New York)

Ferro-chrome. Quotations in this market are 40 to 42c. per lb. of contained chromium in the alloy having 4 to 6% carbon with 35 to 37c. asked for that having 6 to 8% carbon.

Manganese. High-grade ore, 48% and over, has been offered for import at $1.15 per unit, a new low quotation.

Manganese Alloys. Ferro-manganese is quiet and easy at $250, delivered, for 70% alloy with spiegeleisen also quiet at $75, furnace, for 16% and $80 for 18% alloy. These quotations could all probably be shaded. There is no desire to buy except for urgent near-by needs.

Tungsten. Prospects of peace are having some effect in this market, causing hesitancy. The influence of importations of Chinese ore is also felt, according to one authority. Sales in moderate quantity of high-grade ore have been made at $26 per unit in 60% concentrates. Imports from Bolivia have declined. Small lots of good-grade ore are being offered at $21 to $22.50 per unit. Ferro-tungsten is quoted as high as $2.60 per lb. of contained tungsten, but the exact state of the market is hard to gauge.

Eastern Metal Market

New York, October 30.

An easier tone is manifested in those markets that are not ruled by fixed prices, but they are all dull.

The present price for copper has been continued unchanged from November 1 to January 1.

The tin market is lifeless and consumers are awaiting developments.

Conditions in lead are unchanged and the market is under strict control.

Zinc has fallen gradually, with demand very light and prices nominal.

Antimony has declined further in a dull market.

Movements toward peace are bringing rapidly to the front readjustment questions in the steel trade; nevertheless the industry is apparently going ahead at full steam as though the War were to last indefinitely. The expectation of an early peace is reflected in some moves affecting steel. Conflicting currents naturally are confusing. Steps taken in the shipbuilding program in the past week mark the passing of this part of the war program from the wasteful stage toward a basis of economic production. The most efficient yards will be pushed to capacity output but high-priced ones will not operate much longer. Some shipyard extension plans have been cancelled. The output in October of both pig-iron and steel, despite influenza, has exceeded that of September, says the 'Iron Age.' Italy has bought 10,000 four-wheel gondola cars and the 40,915 steel cars for our forces in France has been distributed to 17 American car-makers.

COPPER

It was expected that there would be a meeting on October 25 at Washington to decide as to a new price for copper to rule after November 1, but it was called off. Early this week came the announcement from the War Industries Board that the present 26c. price would continue in force as a maximum until January 1 from November 1. It is understood that the decision was made after an acquiescence by the leading producers. Much depends on international developments as to what will be done about a price to rule after January 1. When peace comes new conditions must be faced and this industry is already preparing, in thoughtful consideration at least, for the new conditions. The influenza epidemic has seriously checked copper output of all kinds. The extent is variously estimated, some putting the decline in production at mines, smelters, and refineries at as high as 20%, due to the inroads of the epidemic alone. Casting copper has been selling at under the fixed price, revealing a surplus as compared with Lake and electrolytic.

TIN

There is little of fresh interest to report. Conditions are practically unchanged from those obtaining a week ago. Consumers are apparently well stocked with contracts, arrivals during the past few months having been liberal. They are buying only what is necessary, pending definite announcement as to Government international control of tin buying and selling. It seems less probable now that a price will be fixed immediately or even in the near future. An official announcement from Washington says that such a statement will come from London where the headquarters of the international pooling arrangement exists. There have been a few sales of small lots of metal en route or spot for about 76c., New York, which is now the nominal quotation. As to import licenses, all new ones are to come only through the U. S. Steel Products Co. It appears, however, that there has been a little relaxation as to other import licenses to those importers having contracts, a few such licenses having been granted, it is said. The belief prevails that such licenses will be granted to take care of all contracts made up to October 1. A Tin Importers' Association has been formed as a result of several meetings in New York recently; it is made up of representatives of all the American and Canadian importers; it has been incorporated, but no announcement has yet been made as to its further plans. Tin arrivals at Pacific ports thus far in October have been 3025 tons, with 475 tons credited to Atlantic ports. For the first time in a long time the London market is unchanged for the week, spot Straits having been quoted yesterday at £334 per ton.

LEAD

There have been no new developments. The metal is scarce with little prospect of any relief for some time. The situation is entirely in the hands of the Lead Producers Committee and were it not for the excellent manner in which the market is being handled there would be much confusion and complaint. By agreement, prices are maintained at a maximum of 7.75c., St. Louis, or 8.05c., New York.

ZINC

It is probable that peace talk has had more effect in the zinc market than in any other. Consumers are reminded that this metal sold very much lower before the War, but those who have studied the present situation do not expect to return to pre-war prices very soon. Costs at present are said to be not far below some of the present prices. Demand has fallen to small proportions the past week and most producers are believed to be well sold up for the last two months of the year. Some grades are really scarce, but quotations are largely nominal in the absence of any real testing of the market. Prime Western for spot and nearby delivery is held at 8.75c., St. Louis, or 9.10c., New York, with November at 8.60c., St. Louis, or 8.95c., New York. For December the quotation is nominal at 8.50c., St. Louis, or 8.85c., New York. There are a few who are offering for first quarter delivery at 8.12½c., St. Louis, or 8.47½c., New York, but there is not much eagerness yet to sell for this position. The weekly Government report of output and stocks is reported to be disappointing, showing for the week ended October 19 only a slight recession in both stocks and production of all grades. Grade A zinc is fixed at a maximum of 12c. per lb., base, but it has been sold frequently below this.

Zinc sheets are held at a maximum Government price of 15c. per lb. with zinc plates at 14c. per pound.

ANTIMONY

The Government recently is understood to have placed an order for 3000 tons, which, of course, has been distributed to various munition-makers. Consequently demand is light again and quotations have fallen slightly until yesterday they were 12.75 to 13c. per lb., New York, duty paid, for prompt and early delivery.

ALUMINUM

Government maximum prices control all dealings in No. 1 virgin metal and in scrap at 33c. per pound for 50-ton lots, at 33.10c. per lb. for 15 to 50-ton lots, and 33.20c. per lb. for 1 to 15-ton lots.

ORES

Molybdenum. The statement is made that a large business has been done for the account of our own Government and that of Canada, mainly of a low-grade ore, the sales going at considerably under $1 per lb. of MoS_2. High-grade material is held at $1.10 nominal.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

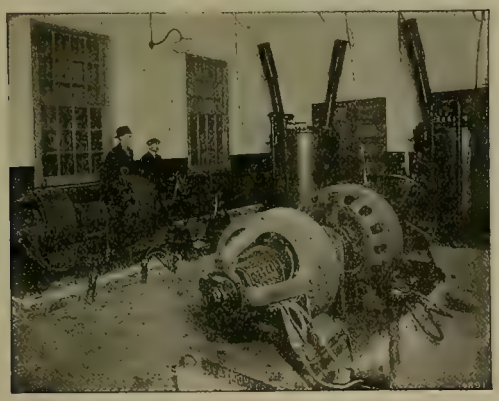
ELECTRIC TREATERS FOR SMELTER FUMES

The tubes containing the high-tension electrodes, and through which the flue-gases pass, are arranged in six groups. The electrodes are suspended at the top from a rack which provides ample insulation, and are connected with the high-tension direct-current line at the bottom. Disconnecting switches permit the current to be cut off from any group to permit inspection and repairs. The gases from

VIEW OF TREATER WITH 13-FT. FLUES DIRECT TO STACK AND TREATER

the furnaces pass through pipes 13 ft. diam., a Y with valves being provided so that the gases can be made to go either through the treater or directly to the stack as desired.

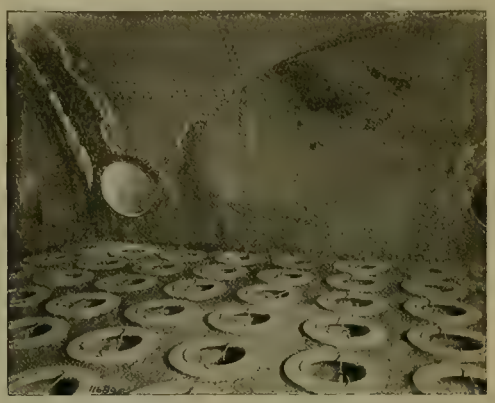
It is stated that tests show that over 90% of the flue-dust can be removed and that the value of the copper, zinc, and other metals recovered will within a short time pay for the treating equipment. It is calculated that at full load ½-ampere high-tension direct-current is needed.



WESTINGHOUSE MOTOR-GENERATORS, TRANSFORMERS, AND RECTIFIERS

Generating Equipment: Two 40-kva. 60-cycle, single-phase Westinghouse generators operating at 1800 r.p.m. arranged to deliver voltage ranging from 150 to 250 volts. A direct-current power line supplies excitation current. A 50-hp. 230-volt, direct-current motor drives each generator.

The transformers are of 40 kva. capacity, 200 volts low tension and 100,000 volts high tension. Additional taps are provided from which voltages of 50, 62½, 75, and 87½% of the maximum voltage can be obtained, the full capacity of the transformer being available on each tap. The high tension leads pass out from the transformers through condenser-type bushings, which are made up of alternate layers of metal foil and insulating material and provide a higher degree of insulation than can be obtained from any other form of construction of the same diameter. Choke coils are located inside the transformers to smooth out the static



INTERIOR OF TREATER SHOWING ELECTRODES SUSPENDED IN TREATER TUBES

surges that are liable to occur on the high tension line. To the motor-generator shafts are coupled the rectifiers for transforming the high-tension alternating current into direct current.

Control Apparatus: The Westinghouse switchboard consists of two panels, one for each generating and transforming set. Each panel carries a circuit breaker from top to bottom on the line between the generator and transformer, an alternating-current ammeter and voltmeter, a switch to reverse the polarity of the high-voltage direct-current, a motor field and line switches, a generator field rheostat, a five-point switch for making connections with the five high-tension taps of the transformer, and the motor starting-rheostat.

The voltage of the high-tension direct-current must be varied according to the condition of the flue-gases being treated. The transformer taps provide the large steps for this variation and the voltage adjustment of the generator the small steps. In addition a bank of adjustable resistance is connected in series with the low-voltage alternating cur-

rent which acts as a ballast and permits of further adjustment of the voltage. These banks are located on each side of the switchboard. Resistance is also provided in series with the high-tension direct-current line by resistance tubes mounted above the rectifiers.

Auxiliary Synchronous Motors: Under ordinary operating conditions, the motor-generators described above are employed so that there is no direct connection between the high-tension direct-current and the power lines of the plant; but in case of emergency, current from the alternating-current lines can be fed into the transformers and used to provide the high-tension operating-current. Under such circumstances the rectifiers driven by the generators cannot be used, so in their place are employed auxiliary rectifiers driven by 2-hp. Westinghouse synchronous motors which keep the rectifiers in synchronism with the current being rectified.

In its last issue the **Standard Oil Bulletin** took occasion to commend the patriotism of the 2205 Standard Oil Co. (California) boys who had entered the army and navy of the United States, as well as the loyalty of those who kept their shoulders to the wheel of one of the most essential of all war industries. The employees of the company have again shown their loyalty by their fine answer to the call for subscriptions to the Fourth Liberty Loan. Advices to the San Francisco office of the company indicate that its 13,000 employees have practically all subscribed, and the amount of bonds taken, either through banks or with the company's assistance, will approximate $2,600,000. This is an average of $200 for each employee. At one refinery more than $300,000 was subscribed by the men, more than the entire allotment for the city of some 25,000 population in which the refinery is situated. In one district 997 Standard Oil field workers out of a total of 1003 subscribed $373,500, an average of $375 per man. The six non-subscribers are foreigners. From Alaska, Washington, Oregon, Honolulu, Arizona, and throughout California the report is the same. Men and women alike have all subscribed, with exceptions too rare to be worthy of notice. The company subscribed for $3,500,000 of the Fourth Liberty Loan bonds. With its employees, it is the largest subscriber in San Francisco, the largest in California, and the largest in this Federal Reserve District. That its own subscription could properly be made as large as it is was a matter of great satisfaction to the board of directors, but infinitely greater is the gratification of the board of directors at the splendid response made by the employees of the company, and at this practical demonstration of their loyalty to their country.

W. H. Wanner, representative of the **Dixon** San Francisco Sales Office, has made the following report on the eleven years' service given by Dixon's silica-graphite paint on the lighthouse buildings at Port Oregon, Oregon: The United States Lighthouse Inspector has two buildings, which are 50 ft. wide by 100 ft. long, with regular gable roofs which were painted eleven years ago with Dixon's silica-graphite paint, and, from present indications, will not require repainting for three or four years to come. These buildings are at what is known as Tongue Point Lighthouse Depot at Tongue Point, Oregon, three miles from Astoria, Oregon. The paint is subject to salt air, sea air, and other severe conditions, and the long service it has given has convinced those in the department interested in painting that there is only one paint, and that is Dixon's silica-graphite paint.

NEW CATALOGUE ON WOOD-STAVE TANKS

The Pacific Tank & Pipe Co. has issued catalogue No. 12, treating of wood-stave tanks for mining, milling, metallurgical, and other purposes. It contains detailed information on general subjects of tank specifications, standard dimensions and capacities, list prices, and telegraphic codes for convenience in ordering. Specific examples of actual

75-TON CYANIDE PLANT AT BLYTHE JUNCTION, CALIFORNIA

installations are also described and illustrated. The view given herewith shows a 75-ton cyanide plant of the Assets Realizing Mines Corporation at Blythe Junction, California, a typical wood tank installation on the desert, unprotected by building or roof. The Pachuca type agitating tank also shown herewith is of all-wood construction with the exception of the bands and air-lift pipe. Accessory apparatus and supplies are also fully illustrated and described, while general data, weights, and measures, metallurgical and chemical formulas all prove to be most useful. This catalogue is for general distribution gratis, and a copy may be obtained by writing to the company at 318 Market street, San Francisco.

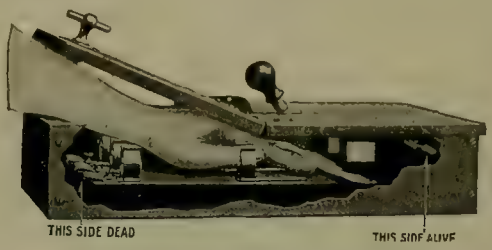
PACIFIC REDWOOD PACHUCA TANK

A SAFETY SWITCH

In many steel mills, factories, mines, and similar industries where most of the workmen have little knowledge of electricity, it is desirable to use switches having no live parts exposed or accessible in the ordinary operation of the switches or when replacing fuses.

This is accomplished in the Krantz auto-lock switch, marketed by the Westinghouse Electric & Mfg. Co. It is intended for use on main circuits or wherever an ordinary knife switch is applied. The switching parts and fuses are enclosed in a steel box, the cover of which is in two parts, one being screwed on to form a permanent covering for that end of the box containing the switch, and the other part being hinged so as to swing back and permit the renewal of fuses, which are located in this portion of the box. An ingenious latching mechanism makes it impossible to open the cover without first throwing the switch to the 'off' position and rendering all fuses and other accessible parts dead. Thus fuses may be replaced at any time with absolute safety. As long as the door of the case is open, the switch contacts cannot be closed.

By using a padlock, the switch handle can be locked in the 'off' position, making it impossible for any one to close the switch, except the person holding the key to the padlock. By using another padlock, the cover may be locked, so that



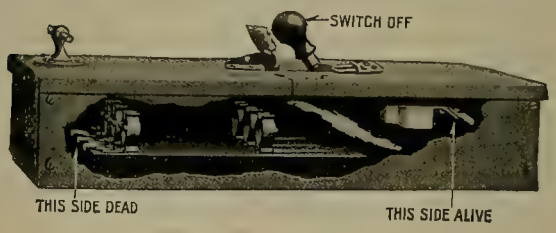
KRANTZ AUTO-LOCK SWITCH, LOCKED IN OPEN POSITION

the fuses cannot be tampered with. Either of these padlocks can be used independently of the other, so that the switch cover can be locked shut with the switch either 'on' or 'off', or the switch can be locked in the 'off' position with the cover either locked or open.

Contact is made by means of a laminated spring copper brush, double ended with auxiliary arcing contacts at each end. The outer leaves of the brush are bronze to provide additional spring pressure.

The stationary contacts are of hand-drawn copper and are mounted on slate bases, one of which in the fused switch carries one of the fuse clips while the other forms the terminal block for the incoming line and is mounted under the stationary portion of the cover.

The operating mechanism is galvanized steel of the toggle



IMPOSSIBLE TO TOUCH LIVE PARTS

type, and is attached to the under side of the stationary end of the cover. This mechanism can be easily removed for inspection by removing several screws.

In closing, the pressure between the contacts causes the laminations of the brush to spread apart, giving it a wiping or self-cleaning action.

The double-ended brushes provide a double break, dividing the arc between the two ends, each of which is provided with a separate arcing tip.

In the closed position the switch is held in positive contact by throwing a toggle over centre. A spring provides a quick-break for opening, the mechanism being independent of the operating handle.

These switches are supplied for 250, 500, and 600-volt, for either alternating or direct-current service, and in capacities up to 2000 amperes.

The safety features of this switch have been recognized by the American Museum of Safety which has awarded it a gold medal and special mention.

DUPLEX TRUCKS

Drilling for oil is a man's size job that requires ponderous equipment. Previous to the advent of the Duplex, most of this work was too strenuous for trucks and had to be done slowly and clumsily by three or four teams of horses. But the 4-wheel drive is changing that. In the Oklahoma fields, especially, the Duplexes sold by the **Stapleton Motor Sales Co.** are performing difficult tasks.

In the illustration, a Duplex is shown hauling a load of lumber over a road that resembles the Missouri river far more than the usual conception of a highway. This truck

DUPLEX TRUCK HAULING LUMBER

has covered about 10,000 miles in the past year. The load pictured consists of 4200 feet of lumber, weighing 13,700 pounds.

Oil-drilling involves much moving of giant boilers from one place to another. In one case the Sinclair Gulf Co.'s 12,000-lb. boiler was moved a distance of 2700 ft. by a Duplex in less than 15 minutes; another three-team job. At another time an oil-pump, weighing 8000 lb., was loaded on the truck by means of a winch and moved to a new location in an hour. The loading alone would have required half a day had horses been used. But the star performance is the dragging of a 100-bbl. oil-tank, weighing 8000 lb., and half full of oil.

Every mining superintendent and engineer who uses belting for power transmission knows that the product of modern methods is vastly superior to that of a generation ago. Yet a large proportion of the increased service possibilities of this better belting is lost because old-time methods of joining are persisted in. Knowing that the busy man enjoys a shaft of humor even when it strikes his own practices, the **Crescent Belt Fastener Co.** has just issued a booklet which treats of the serious subject of belt joining in a humorous way. This 24-page booklet, entitled 'Gone Again', is written in the way of a 'movie' comedy, and may be obtained at the Sales Department, Crescent Belt Fastener Co., 381 Fourth Avenue, New York.

The Chicago Pneumatic Tool Co. announces the appointment of A. M. Brown as district manager of sales, 1740 Market street, Philadelphia, succeeding G. A. Barden, who remains in Philadelphia as sales representative for the company. For some time past Mr. Brown has been located in the New York offices of the company as assistant manager, Compressor Sales Division. Announcement of changes in executive officers was made in a previous issue.

RECENT PUBLICATIONS

U. S. Bureau of Mines Bulletin 127: 'Gold Dredging in the United States,' by Charles Janin, 226 pp. A valuable monograph, enriched with many useful drawings.

Technical Papers From the Argentine Republic:

Annals of the Ministry of Agriculture, geologic and mining section. Vol. XIII, No. 1. Geology and hydrography of Bahia Blanca, and vicinity; accompanied by an economic-geologic map of the Argentine Republic on a scale of 1:200,000, section 35, sheet M; by Dr. Ricardo Wichmann, 1918.

Ditto, Vol. XIII, No. 2. Monograph on a petrographic study of the rocks of Argentina, with reproductions from enlarged micro-photographs of thin sections; by Dr. José M. Sobral, 1918.

Bulletin No. 9, Series D, mineral chemistry and mineral waters; the thermal waters of Rio Hondo, Province of Santiago del Estero; by Dr. Hércules Corti; with numerous maps and photographs; 1918.

Bulletin No. 17, Series B, geology; investigation of the tectonic structure of the imbripheral basin of the Rio de la Rioja, with reference to its effect in diminishing the water supply for that river; by Dr. Juan Rassmuss, 1918.

Bulletin No. 10, Series D; the thermo-mineral waters of Villivicencio, Province of Mendoza; by Dr. Héctor H. Alvavez, 1918.

The Diesel Engine. By Herbert Haas. Bulletin 156, U. S. Bureau of Mines, Washington, D. C. Pp. 130. Ill., index.

The author discusses liquid-fuel engines and then takes up the Diesel engine in detail, including design, fuels used, lubricating-oil, relative equipment, examples of successful use, and types of American-made engines. This is one of the best presentations of this subject yet made.

Efficiency in the Use of Oil Fuel. By J. M. Wadsworth. Pp. 82. Ill., index. U. S. Bureau of Mines, Washington, D. C.

In 1917 it is estimated that 40,000,000 bbl. of fuel-oil, or one-fourth of the total amount used, was wasted through inefficient operation of boiler-plants. The present volume is the result of an endeavor by the U. S. Bureau of Mines, acting in co-operation with the U. S. Fuel Administration, to reduce this waste. The author considers the various features of boiler-plant design and operation and points out methods for obtaining efficiency. The text is supplemented by numerous illustrations and tables. The book is of convenient pocket size, and should be in the hands of everyone concerned with boiler-plant operation or design.

BOOK REVIEW

Steel Shipbuilders' Handbook. By C. W. Cook. Pp. 123, with four plates in insert. Longmans, Green & Co., New York. For sale by 'Mining and Scientific Press.' Price, $1.50.

This is a dictionary of several hundred special words and phrases used in the shipbuilding industry. Four plates are included, showing the principal parts of a steel ship. Where any terms given in the body of the book are illustrated in the plates the definition gives a reference to the particular plate. The book will be of great value to those interested in the steel shipbuilding industry, particularly the many thousand that were unacquainted with that industry until a few months ago.

Mining and Scientific Press

Edited by T. A. RICKARD

Volume 117
Number 20

SAN FRANCISCO, NOVEMBER 16, 1918

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$4 per Year

AN INDEPENDENT WEEKLY PAPER OWNED, EDITED, AND MANAGED BY ENGINEERS

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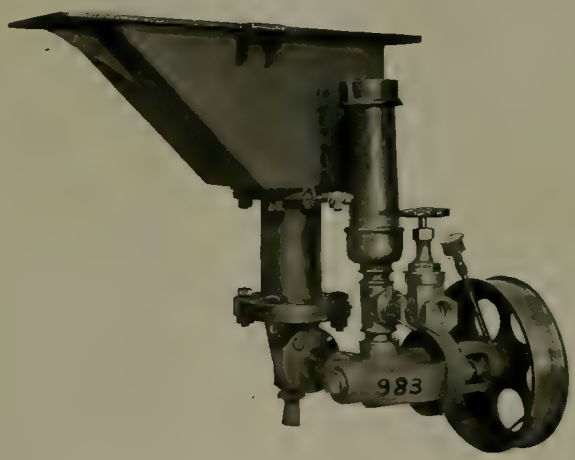
Buyers' Guide, Page 42
Advertisers' Index, Page 50

LAUNDER CLASSIFIERS

The Launder type Richards Pulsator Classifier is designed to meet the demand for an inexpensive device that will furnish a classified product for one table, or for 2, 3, 5, 10 or any number whatever. A classifier that may be attached to your already existing launder—at just the right location nearest the table or tables you desire to feed—to draw just the right amount from the pulp in the launder—classify it to make a perfect product for your table—and deliver it to the table in just the right quantity.



The Pulsator Valve is made in one size but fits any sorting column. Sorting columns are made in five sizes, viz: 2½, 3, 4, 5 and 6 inches diameter. Settling pockets are made in six sizes to fit different sorting columns.

Let us send you our Bulletin No. 1059

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T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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BUSINESS STAFF:

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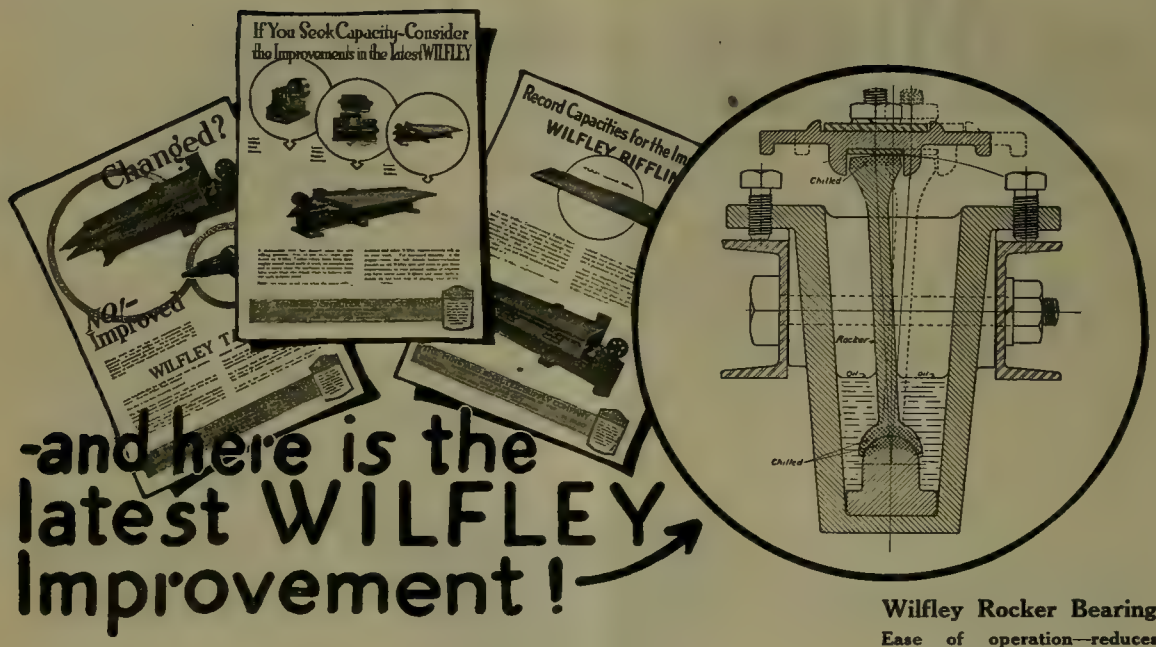

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EDITORIAL

"MINE eyes have seen the glory of the coming of the Lord." We salute the dawn of a better day, and thank God that the long-drawn horror is past.

AT this eventful hour we feel sorry for the older generation that died during the period of the War and missed the supreme satisfaction of witnessing its victorious conclusion; so also we feel sympathy for those of the younger generation that enlisted as soon as they were able and yet were deprived of the opportunity to do service at the Front. On the other hand we envy the news-boy that is privileged to shout "Abdication of the Kaiser!" "End of the War!" "Wuxtry!"

SAN FRANCISCO lost more lives in the epidemic of influenza than in the earthquake-fire of 1906. The death-list is given as 1605; the total loss due to earthquake and fire in San Francisco and the neighboring communities was about one thousand.

IT is announced that the Supreme Court of the United States has granted a writ of certiorari for a review of the decision of the Ninth Circuit Court of Appeals in the case of Minerals Separation v. Butte & Superior Mining Company.

FOUR more articles on the Utah Copper enterprise, dealing with milling, leaching, and smelting, will appear at an early date. Delay in publication has been caused owing to the collection of the necessary illustrations.

CAMBRIDGE university gave 14,840 of its members to the British army and of these 8407 are casualties, the killed numbering 2382. This is a noble sacrifice and reminds us that Harvard, the younger Cambridge, has shown an equally fine spirit, although not called upon to make a sacrifice so great as the sister university.

DESPITE the recent protestation of the German government against the imputation of inhumanity and barbarism in the waging of war against civilian population of invaded countries, it is clear from numerous trustworthy reports that the people of the evacuated districts in France and Belgium have been subjected to the now familiar German methods of destroying private houses before retreating, of driving their inhabitants like cattle into the fields, of looting, and of bestialities unmentionable. For all this they will be held to account, more particularly the officers in command. We note that the British Home Secretary, speaking in the House of Commons, on November 5, stated that the names of those responsible for such acts will be demanded by the Allies and that they will be brought before a proper court for trial and punishment. It is high time for an outraged civilization to assert itself and for the doctrine of individual responsibility to be enforced.

IF Germany falls into political chaos, the War will have what boating-men call a dirty finish. To make peace with or to exact indemnity from a Bolshevist mob is impracticable. We hope that the transition from Prussian autocracy to some form of popular government may be effected without the entire disruption of social order in the late German empire. The greater literacy and the habits of discipline of the German people ought to keep them from falling into anarchy. We want to see an organized Germany able to make an accounting for her misdeeds, not a politically drunken sot that cannot be held responsible.

CHANGES made recently in the personnel of Señor Carranza's government at Mexico City are said to indicate a trend of sympathy away from German propaganda and a turn toward pro-Ally influence. We are informed that conditions in Mexico are improving steadily, particularly on the west coast, where mining activities are increasing. Most of us have hoped that the end of the Great War would synchronize with the restoration of order in Mexico and we still hope that among the steps to be taken to make the world safe for democracy will be an effort to end the rapine and riot that are as dangerous to democracy as Prussianism itself.

A YEAR ago there was talk of sending American colliery engineers to assist in the rehabilitation of the coal mines in the Valenciennes region, which has now been cleared of its German despoilers. Unfortunately the long-continued fighting in this part of France, together with the wanton sabotage of the Germans, has wrought enormous damage. The photographs of Lens now appearing in the illustrated papers show to what

ruin one of the principal industrial centres of France has been reduced. In their possession of these fuel resources for four years and in their systematic destructiveness, the Germans have done an injury to France for which we hope to see them compelled to pay to the hilt. Meanwhile it is probable that the French will need, not engineers, for their own are thoroughly capable, but American machinery, particularly of the standardized type for which our manufacturers are pre-eminent.

WHILE going to press the terms of capitulation are published. The surrender is as complete and as abject as any of us could wish. They leave Germany helpless, and ensure the imposition of terms for perpetual peace. The compulsory evacuation of the region west of the Rhine is of tremendous import. The surrender of military material is on a big scale, and the expropriation of warships is not only large, but it includes practically all the submarines remaining in the Enemy's hands. Nothing is said about the crown properties or the private wealth of William of Hohenzollern and his family, but it seems reasonable to expect that the new government of Germany will avail itself of these resources to pay the indemnities enforced by the Allies in reparation for the damage done by the German armies in the countries they invaded and looted. Justice is being done.

RESENTMENT has been expressed generally against the hoax perpetrated by the United Press on November 7, when the president of that news agency, Mr. Roy Howard, sent a cablegram from Paris asserting that the armistice had been signed at 2 p.m. that day. The premature celebration incited thereby had the effect of rendering the real event something of an anti-climax. It is to be hoped that an official enquiry will be made into the affair in order to ascertain what motive prompted Mr. Howard's action or whether it was only an extreme phase of journalistic irresponsibility. Having issued the telegram in the morning, why did the United Press fail to confirm or correct it during the course of the day? Here in San Francisco the 'Bulletin' re-affirmed the mendacious news for ten hours. The sinister suggestion of a stock-exchange scheme obtrudes itself, seeing that there was a sudden rise in quotations, more than sufficient to enable unscrupulous persons to make a lot of money if they were aware in advance that the cablegram was to be sent. We recall the detailed story that circulated through the financial centres of Europe regarding the coup made by King Nicholas of Montenegro by agreement with a firm of brokers at Vienna to let them know a few hours in advance of his declaration of war against Turkey in 1912. We recall also the story that Von Bernsdorff made a fortune by acting in anticipation of the break in diplomatic relations between the United States and Germany in 1917. It is hard to understand how any intelligent and honest man could have done as Mr. Howard did; either he is an egregious fool or a scurvy knave. It seems worth while to ascertain the proper label. We are sorry that the United Press has discredited itself so thoroughly, because the event will help Hearst's lying press-agency and strengthen the Associated Press, which already has a control perilously near to being a monopoly of news distribution. Some measure of government control over the press-agencies is highly desirable for the protection of the public.

THAT bogus despatch of the United Press was a poor piece of journalism, apart from the decisive fact that it was false. It was worded in the language of a high-school sophomore. What need was there, in such a momentous message, to state that "the German delegation had come into the Allied lines under a white flag." Would they enter under cover of a red flag? Again, Mr. Howard injects a description of Sedan as "one of the historic cities of Europe." Sedan is not a city but a battlefield; it is a small fortified town rendered famous by an event to which no descriptive reference is necessary. It is not worth while talking to anybody unaware of the association of ideas evoked by the word Sedan.

AMID the blatant newspaper exaggerations of American performances in the War, it is gratifying to read the testimony of such a competent critic as Mr. Frank Symonds to the achievement of Pershing's army northwest of Verdun and along the front from Metz to the Argonne. This was the hinge of the big swing made by the German armies in their retreat and at this hinge was concentrated their most bitter resistance. From September 26 to the finish the Germans had to rush division after division to that part of the front to stay the American offensive, thereby weakening the opposition to the British attack on the Hindenburg line and their subsequent advance into Belgium. For four weeks our boys, including Californian units, fought the Enemy's veterans in the wastes of the Argonne and drove them back step by step after the most intensive fighting. On November 1 the German line was broken and the road to the Middle Meuse was opened. This was one of the major operations of the War and greatly to the glory of our First Army.

The Day

The hour of triumph finds many of us disinclined to be noisily jubilant; we accept the succession of tremendous events with quiet exultation and deep gratitude. The relief is so great and the victory so complete that ordinary gestures of delight seem unfitting. It is as if someone dearly beloved and long in the grip of a fateful illness had finally been declared by the doctors to be out of danger; it is as if a mad dog after running amuck during long days and nights had been killed. At last the Pan-German menace has been thwarted, the armies and navies of the Allied peoples have conquered, the orgy of bestial violence is ended, the law of civilization has been asserted. In the days before Armageddon, long

before we dreamed of the horrors they were preparing to bring upon the world, the Germans toasted 'Der Tag', the day when they were to goose-step across creation, when they were to impose their notion of things upon a subjugated world. Their paranoiac chief talked frothily about the German sword and spoke insolently about his partnership with a tribal god. We thought it merely the eccentricity of a feudal king and the heady conceit of a successful people until, almost too late, nation after nation had to face the grim reality of wild talk that was translated into wilder deeds. Now that nightmare has gone; we awaken to a sane world; 'The Day', not 'Der Tag', has dawned and we salute the sunrise of a happier dispensation. The German marauders have been beaten, we have frustrated their mad design, and we give thanks to God that the horrible menace has passed. Each of the associated enemies has capitulated, the leader of the great conspiracy has been driven from his ensanguined throne, and his captains have been forced, by a series of defeats on land and sea, to come humbly asking for a truce, the preliminary to an abject surrender. By a series of wonderful coincidences the pages of history have been re-written in the words of human freedom: an Allied army has been welcomed at Sarajevo, where was lighted the spark that set the world aflame; the victorious Italians have marched through the gates of Trent and Trieste; French and American troops have over-run Sedan and given a new meaning to a name of tragic memory; British armies have reached both Mons and Waterloo; the Belgians, the first to know the invader's heel, have the satisfaction of seeing him humbled in the dust of their own soil; where the German first proclaimed his disregard of all law, human or divine, there today his sword is broken and his honor abased. Never has history witnessed an end so shameful to so grandiose a scheme of conquest. It is true, the Germans made a courageous fight, wonderfully sustained, but it has been defamed for all time by the way they have behaved; it has been a brave fight, but a dirty one. The German military caste has not only failed utterly, it has been dishonored. The blood of helpless non-combatants, on sea as well as on land, of innocent women and children, cries to heaven from under the waves and from amid the ruins of devastated hearths far from the battlefield. We are as little willing to shake hands with our defeated enemy as with a burglar that has been caught in the act of murder; when we think of the millions of happy lives sacrified to stay his bloody hand, we feel less like a victor than a judge putting on the black cap to pronounce sentence. No sentiment of generous admiration for a fallen foe mixes with our joy today; on the contrary, that exultation is crossed with contempt for an opponent that did not play the game. But enough of him, let us turn to think of the immortal dead that lie in Flanders field and elsewhere in the wake of the victorious battalions that have borne our flag to victory; to them we rise today in silent salute: the thought of them restrains our hilarity, making us deeply sensible of the cost of victory and firmly determined to conclude such a peace as shall be worthy of their sacrifice in the cause of human freedom. To the hosts of the living, now standing to arms while the terms of capitulation are being enforced, to them we cannot say all that we feel, to them and to the gallant sailors that kept the seas against submarine piracy, we reach forth the warm hand of unspeakable gratitude.

An Old Story

In a recent issue of the 'Financial Times,' of London, we read an account of the annual meeting of the Messina copper company operating in South Africa and notable as one of the companies with which Mr. Hoover was identified until he resigned, as chairman, in order to devote himself to more important work. In the report of the speech made by the chairman, Mr. C. F. H. Leslie, who is well versed in mining affairs, we found a statement that arrested attention on account of the fact that it echoed a fallacy upon which it seems worth while to animadvert. The statement was as follows: "At times we have been much encouraged by finds of higher-grade ore, as well as by the view of Mr. Graton, one of the great base-metal geologists of the world, whom we consulted, that there was no inherent reason why we should not find as rich ore in the lower levels as in the upper levels of the mine. Yet we must look at this fact, that ever since the year 1913, although the tonnage of ore-reserves has sometimes shown considerable increases, the average assay-value of that tonnage has shown a constant fall from 10% [copper] in the year 1913 to 5.7% up to 30th June last." This explanation, by a conscientious director, has a pathetic interest particularly to those experienced not only in mines but in men, not only in ore deposits but in the organization of companies to exploit them. Here we have a copper mine that is giving unmistakable signs of impoverishment in depth, a chairman that is telling the truth to his shareholders, and a geologist that has been engaged to give advice at a critical juncture in the development of the mine. The setting is dignified and the *dramatis personae* are eminently respectable; obviously, this is not an opera-bouffe performance, but legitimate drama. Nevertheless, like Hamlet, the play seems to be full of quotations, for we recall having heard or read similar remarks on similar occasions in years gone-by. First, the facts: steady decrease in the copper content of the ore during five years as the mine has been deepened; patches of rich ore, reminiscent of the upper levels, in the deeper workings; a report by an eminent expert stating that there is no inherent reason" why the ore in the deepening workings should not be as good as it was on the upper levels. We hasten to say that the term "eminent expert" is quite properly applied to Mr. L. C. Graton and that if we were in need of geologic advice on the vagaries of ore deposition in a copper mine we would turn to him for help. The fact that he is an acknowledged authority on the subject merely serves to give point to the comment that we venture to make on the incident. We hold that there *is* an "inherent reason" for fearing impoverish-

ment in depth, because non-persistence inheres in the nature of ore deposits, as we know from the evidence of cumulative fact. The geologist may ascertain, by study of the structural conditions, that a lode or vein is likely to persist below a certain horizon, but it is not given him to predict the recurrence of rich ore once the zone of secondary enrichment has been passed in the course of deepening operations. The idle shaft-houses and abandoned workings of old mines all over the world afford eloquent, and derisive, denial of the alluring dictum that "There is no inherent reason why the ore is not as rich in the lower levels as it was in the upper levels." A mine is a wasting asset; its life depends upon an ore-body that is the product of the processes of Nature at work with infinite patience for a period, or for successive periods, covering tens of thousands, even millions, of years. Man digs into the metallic treasure so patiently and laboriously accumulated in the rocks; he removes it in a few years, or at most in the time of one of his brief generations. His process of exhausting the ore is swift, that of nature in making it is slow; the one is like the cutting down of a tree, the other like the growth of a giant of the forest. The impermanence of mines inheres in the non-persistence of ore.

Regulations for Publishers

As our readers are aware, newspapers and other periodical publications are classed as 'essential' at this time. This view of the usefulness of the press is eminently sane and democratic, for it is a recognition of the fact that, despite notable exceptions, the newspapers and other circulating pages of print have done great service in creating a healthy national spirit and in furthering the great cause to which every good citizen is committed. The press has been a tonic to the morale of the Nation, and if Hearst and other exponents of jaundiced journalism have proved true to form, they have served mainly to furnish a contrast. The work of clean journalism, as distinguished from the gutter press, has not been performed without serious handicap, of course. Shortage of raw materials has hindered expansion and penalized energy. An increase in the price of paper, in our case from 4¾ cents to as much as 10½ cents per pound, took place long before there was any excuse for raising prices. Profiteering marked the manufacture of paper early in the War; combinations of manufacturers exerted an illegitimate influence on the market as soon as there was an excuse for taking advantage of abnormal conditions. We were victimized like others. Later, the embargo on exports of pulp from Canada did create a shortage of paper, particularly news-print paper, not book-paper, such as we use, and the War Industries Board granted priority to the paper-mills in order to alleviate the condition of the trade. In doing so, the Board insists that no paper shall be wasted. The needs of the Government caused a shortage of sulphur, bleach, and freightage, thereby giving a reasonable excuse for a small rise in the cost of book-paper, and justifying the regulations issued by the War Industries Board for the conservation of paper. These regulations have killed a number of practices established by years of custom. Some of them are bad business and it is well that they should be stopped; for instance, all 'free' circulation is prohibited. In July the Post-Office issued an order that only one copy of a paper should be sent to an advertiser and only a copy of the issue in which the advertisement appeared. We were sending as many as 18 copies to single advertisers, that is, to their various branch-offices and agencies; now, if they want more than one copy, they pay for it like anybody else. Next a series of nine suggestions of a mandatory character have been made by the War Industries Board; for instance, every publisher is asked to limit his consumption of paper to 10% less than what he used in the year ended on June 30 last, such decrease being calculated upon the quantity he would have consumed had he used paper of the maximum weight prescribed by the Board, deducting from this amount half the quantity covered by the 'suggested' economies. The apparent deduction of 10% is actually about 22% in our case. The 'suggestions' also include the discontinuance of sending papers after the expiration of a subscription, unless paid in advance; no more complimentary copies; no free exchange between publications; no return of unsold copies from news-dealers; a reduction in the number of sample copies to 1% of the circulation; and no selling of papers with premiums unless the combined rate is at least the full price of the premium plus 75% of the published price of the periodical. Another interesting regulation is an embargo upon guarantees of circulation as a basis for the establishment of advertising rates. This is a salutary suggestion. The efficiency of a paper as a medium of publicity is not dependent upon the number of copies printed, issued, or circulated, but upon the extent to which the paper is read. An unopened copy or a copy set aside is barren of result to the manufacturer whose advertisement appears in that issue; on the other hand, a single copy may be read intensively, so intensively as to include the advertising pages, by a dozen people. No new publication may be established during the period of the War unless it be shown that it is necessary to the national purpose at this time. The combined result of these prohibitions and inhibitions will be to kill irresponsible and illegitimate publishing, but not to injure genuine business more seriously than is the share of everybody during this critical period. So far as the Mining and Scientific Press is concerned, the purchasing power of its subscription list has not suffered at all; several hundred subscribers have discontinued and gone to fight their country's battle overseas; we are proud to number them among our supporters; their places have been taken by older men or their duties have been merged temporarily with those of the technicians that remain at their former posts. We have doubled our subscription list during the last three years; this paper has been published for 58 years and it never had better support than today; we face the future cheerfully knowing that the national purpose will be fulfilled to the hilt.

From the Front

The Editor:

Sir—Let me start my note by asking your pardon for using a pencil. Ink is very hard to obtain when one is at the Front. I've just received the PRESS of August 10, and after reading it from end to end I felt I should just drop a line and try to tell you how much news of my own profession means 'up here'.

It would seem nowadays that the mining engineer has little place in the War, that is, if held strictly to his experiences in underground operations, but happily the training of mining men has usually been so broad that one finds them at home in almost any branch of military engineering.

Since the arrival of my regiment in France last May we have been quite active and have seen a large part of the country. On our arrival we were attached to the British and through their courtesy and splendid spirit of hospitality and general desire to lend a hand we started a period of training that unfortunately was ended in a short time. I say "unfortunately" because we were all beginning to understand one another and to brush away a lot of unfounded prejudices. They were finding out that all Americans were not typified by the pre-war tourist and we in our turn were learning that they were fine fellows and not the overdone comic-opera idea of the American playwright.

Soon we came in contact with the French and here, much to the surprise of many, we found less difficulty than had been expected. I've seen our boys spend hours with the French soldiers and talking with arms, hands, and feet, yet they seem to understand one another. A book would not hold all the amusing incidents that happened to us in learning the game of billeting. But all that has passed now, we're veterans, that is, with respect to the American Army, and have been in the line four times. Our division has been cited twice and is known as the shock unit.

Our baptism of fire was rather sudden, but glorious, for we took part in that memorable counter-offensive which marks the turning point of the War—that never to be forgotten 18th of July. At the time part of my regiment was hurriedly rushed up to the Front the night before the attack was to take place and part of it was set to work to improve the secondary defence line. Never shall I forget that day. We had received the news that all was ready. That morning I stood on a hill just behind the line watching and waiting. Suddenly at 4:30 our barrage opened. Guns were firing all around us. Rockets flew heavenward from the line. Aeroplanes began to arrive in countless numbers and as they flew over they signalled the balloons to arise. Then in the dim half-light we could make out their sausage-like shapes springing up like some huge fungus growth. Suddenly, as if to proclaim our 'Day' the sun came over the horizon in a burst of splendor and turned the sky to a brilliant crimson. Little did we realize then what it all would mean. Each day saw us move forward over the torn ground that had been held by the filthy Hun—an old story to many, but how new to us! August found us up against a stiffened resistance but still going, and at last we reached the Vesle river. Here was where we played our most important part. Our boys built bridges across the river for the infantry in the face of machine-gun fire, snipers, and gas. Thenceforward we were in the War and no mistake.

How sweet was relief when it finally came and when we found ourselves back in the rest area where we could have a light at night, a bed, a bath, and even hear a real American girl sing to us at the 'Y'. It seemed like heaven. All good things have an end and we're at it again.

Each time we go up our work is different. This time we built a road over the No Man's Land of four years and went over the top carrying artillery bridges. As I write our 'heavies' are pounding away at the Hun and shake the very ground about us. I've been living in a German dug-out for a week, and thankful for it too—especially so, as the other night Fritz seemed bent on putting some of us out of action. One shell landed fairly on top of the dug-out and, needless to say, we all turned over rather suddenly. Sometimes it seems as if his shells have eyes the way they seek one out.

By the paper today I see that they are trying for peace. There is only one way to get it, and we've told them how, otherwise it's useless for them to waste our time. September saw 312,000 men brought over, which seems to be a rather strong answer to any false steps the Hun may make.

I'm afraid I've written at too great length and failed to say what I had intended. Capt. Newberry and I are the only mining engineers in the regiment and how good it is to read of the doings in the mining world. Many times have we wished we could get on the cage and drop down to the 500 or some such level. It's strange how one misses the things that formerly were everyday occurrences. Without doubt our appreciation of small things will be increased tenfold by the time this game is over and truly for the good of us all.

I note with regret the death of your brother's son Forbes, Jr., and hope you will convey to his father my

sincere sympathy. Our country can well be proud of such splendid men as that.

I have seen our boys advance without a waver upon solid cement 'pill-boxes' and go into battle as unconcerned as men going to their daily tasks. Such spirit as that is bound to win and the peace-talk of the Kaiser and his tribe will have no effect on their attitude. Our usual daily noon-time hate has started. Fritz is throwing a few of his big ones in, but with little effect.

I hope you'll forgive me for having taken so much of your time, one gets lonely up here and feels the need of talking to someone in his own language, although as I look back, I've said very little about mining. At times it seems strange to be here, especially when I recall that day more than four years ago when I called on you in your London office just before this world calamity started. And here I am in it!

Yesterday I saw seven Hun planes brought down in their unsuccessful attempts to burn some of our balloons. One thing is certain: while life lasts it is full of thrills. I often wonder if when it's over and we go underground again there won't be a tendency, when some one is about to shoot a round, to just flatten up against the side of the drift and let her go by. That may be the result of some of the close calls one has when a shell explodes rather close.

Let me assure you in closing, that I look forward to each PRESS and hope that some day I'll be able to talk again in terms of the good old days. With my kindest regards.

E. G. SNEDAKER,
1st Lt. Eng. U. S. A.

The Gold Problem

The Editor:

Sir—In the article entitled 'Review of the Gold Problem' in your issue of October 26, H. N. Lawrie says "That it should cost more to produce an ounce of gold as a commodity than the monetary price of $20.6718 per ounce, is an economic eccentricity: yet, when it is realized that *this price was arbitrarily established by England in* 1812 without regard to the cost of production, it does not seem so unreasonable, with the present inflation of commodity prices, that this condition should exist. In fact the price of 85 shillings per ounce for gold, paid by England, in 1812 was above the market price at that time." The italics are mine.

In 1812, silver was the standard of value in the United States and the silver 'dollar' was the unit of value. The gold coins consisted of the eagle, half-eagle, and quarter-eagle, having the face-falue of ten dollars, five dollars, and two and a half, respectively. The eagle weighed 270 grains (the half and quarter-eagle in proportion) and was eleven-twelfths fine. The eagle therefore contained 247.5 grains of fine or pure gold, and a 'dollar', or one-tenth of that weight, would be 24.75 gr. At 24.75 gr. to the 'dollar' a Troy ounce of gold would be 19.39 'dollars' (480 ÷ 24.75) instead of $20.6718, as stated by Mr. Lawrie.

Owing to the fluctuations in the commercial ratio between gold and silver, the gold in the gold coins had become worth more as bullion than it was as money, and from 1805 to 1834 our gold coins were exported. In 1813, the gold in an eagle (247.5 grains) was exchangeable, commercially, for 4009.5 grains of silver ($10.80), a ratio of 16.2:1, whereas the coinage ratio was 15:1.

In June 1834, an attempt was made by the Congress to restore gold as currency by passing an act reducing the weight of the eagle to 258 grains, of which 232 grains were pure gold, equal to a fineness of 889 225/1000. On January 18, 1837, the Congress passed a law making 900/1000 the fineness for both gold and silver coins. This act reduced the amount of pure gold in the eagle to 232.2 gr. (nine-tenths of 258 gr.), which is at the rate of 23.22 gr. for one 'dollar', but the gold 'dollar' did not actually come into existence as an individual coin till 1849.

From 1812 to 1837 is 25 years, therefore the "monetary price" of $20.6718 for an ounce of gold was not made until a quarter of a century after the date named by Mr. Lawrie: also such "monetary price" was established by the Congress of the United States without the least particle of aid from England.

Again, Mr. Lawrie says "That it should cost more to produce an ounce of gold as a commodity than the monetary price of $20.6718 per ounce is an economic eccentricity."

Although it may cost, at a certain low-grade gold mine, considerably more in labor, power, powder, steel, etc., than the monetary equivalent of 480 gr. of gold to produce an ounce of gold, one fails to descern what that has to do with the undeniable fact that 480 grains divided by 23.22 grains gives a quotient of 20.67183+. The latter is a very simple mathematical problem and in no sense can it be considered an oddity in political economy: it has nothing whatever to do with the cost of producing an ounce or any other quantity of gold; nor does the fact that, in 1812, England decreed arbitrarily that, in coining gold, it would divide 20 lb. Troy weight into 934½ parts or pieces and call each one a 'sovereign' or 'pound sterling' have anything to do with the fact that the United States decreed arbitrarily, in 1837, that it would divide an ounce of gold into 20.67183+ parts and call each one a 'dollar'.

Furthermore, the quotient obtained by dividing a Troy ounce (480 gr.) by 113.+ (the number of grains of gold in a sovereign) is 4.247+, which means, simply, 4.247+ sovereigns together contain a Troy ounce of gold. 4.247+ sovereigns multiplied by 20, the number of shillings in one sovereign, gives a product of 84.95 shillings; but this means, simply, that 84.95 shillings, in gold, weigh 480 grains; but that has nothing whatever to do with the worth, exchange-value, or purchasing power of a Troy ounce of gold.

W. DE L. BENEDICT.

New York, November 2.

CONCRETE having a temperature of 55°F. is warm enough for complete setting in freezing weather.

SAN FELIX, ON THE ORINOCO

THE ORINOCO RIVER AT SAN FELIX

The Gold District of Venezuela

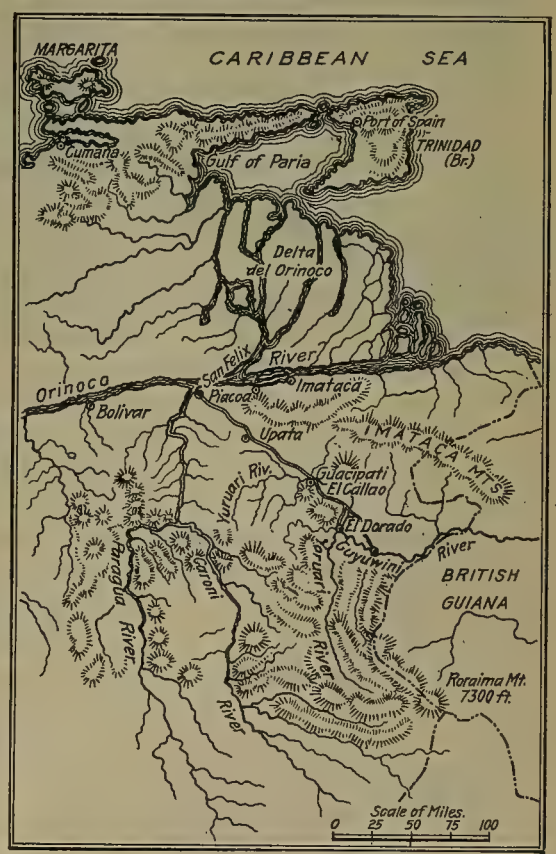
By H. HUNTINGTON MILLER

The principal gold-bearing area of Venezuela occupies the south-western portion of the Republic, extending from the headwaters of the river Yuruari down to the frontier of British Guiana. The river Caroni, one of the chief tributaries of the Orinoco system, bounds the district on the west, but this region has as yet been but little explored.

The portion of Venezuela embraced within these limits, and now known as Spanish Guiana, was once thought by the English to be the real El Dorado of the Spanish padres. Sir Walter Raleigh, in one of his western voyages in search of the elusive El Dorado, headed an expedition to the Orinoco in 1595 and explored the river in small boats as far as Ciudad Bolivar, or Angostura. He collected samples of gold and diamonds, brought to him by the Indians, but failed to find the source of either.

This part of Venezuela is of large extent, almost one-third the entire area of the country, without including the vast stretches of unexplored territory to the south and west, and from it Venezuela derives a considerable proportion of her revenue, in the shape of taxes on gold, rubber, chicle, and dye-woods, as well as from cattle and other minor industries. The country also contains vast stores of valuable hard-woods, but this source of wealth has small value at present, owing to the high cost of transportation.

The interior is best reached by means of the Orinoco river, which is navigable during most of the year for ocean-going steamers as far as Ciudad Bolivar. The nearest part of the gold district lies 150 miles south-east from the little port of San Feliz on the Orinoco, whence a wagon-road of fair quality connects with the mining town of El Callao and extends to the lower part of the district, 50 to 100 miles south-east. Some traffic is also maintained with the lower country by means of large flat boats and launches which come up from British Guiana; but as the Venezuelan government exacts high duties on all classes of merchandise and supplies coming into the



MAP OF VENEZUELA

country, as well as on all gold, rubber, etc., exported, the overland route, from San Feliz on the Orinoco to El Callao, is the more important.

The distribution of gold is general throughout this extensive area and its occurrence can be divided into three types: true alluvials, belts or zones of shale, and quartz veins.

The alluvial deposits are mainly confined to the extreme south-eastern portion, close to the border of British Guiana, the same formation extending across the frontier into that country.

Some placer gold is also found along the Caroní and especially one of its branches, the Paraguá; and the smaller tributary streams of the Orinoco just above Angostura are reported to afford gold, although these parts are as yet little explored.

The extensive belts and zones of auriferous shale and schist are probably the original source of the alluvial gold, which is derived from an intricate system of quartz veinlets, frequently uniting to form pockets of considerable richness. A study of the rock formation indicates that the gold was contained within stringers and crystalline grains of arsenical pyrite. The oxidation and decomposition of this mineral and of the friable schist that encloses it, has resulted in the formation of the dry pockets for which some portions of the district are famous. The gradual weathering of the schist and the washing out and concentration of the gold in the beds and banks of the streams have originated the placers of the lower country.

The gold-bearing quartz veins so far discovered are mainly confined to the more northerly portion of the district around the old town and mine of El Callao, which, during the period of its maximum production, ranked among the notable mining ventures of the world and is reputed to have produced $50,000,000 in the thirty-odd years of its life.

The veins occur near, or enclosed within, a series of eruptive dikes, mainly of diabase, which have fractured the schist. During the period of its maximum activity, thirty years ago, the El Callao district had a number of operating mines and several mills were running, with a total capacity of 1000 tons per day. The richer deposits, however, were soon worked out, and with increasing depth the veins became poor and refractory. Steam being the motive power and the neighboring forests being rapidly devastated, scarcity of fuel and increased cost of pumping, together with the impoverishment of the veins, caused the stoppage of one mine after another until only three companies are now in active operation, while a fourth, the successor of the original El Callao, has suspended operations pending the conclusion of the War.

The three companies still operating are the following:

Gold Fields of Venezuela, Ltd. This is an English corporation, with headquarters at El Peru, owning a large group of mining claims about four miles west of El Callao. The ore, after being crushed, is ground in two Chilean mills with addition of quicksilver. The discharged pulp is passed over amalgamation plates and the tailing from the plates is treated in steel tanks by cyanidation. The ore yields from ½ to ¾ oz. gold per ton.

El Amparo Mine, Ltd. This is also an English corporation owning the majority of stock in another company of similar name incorporated in Venezuela to work the once famous La Paz bonanza, one of the surface pockets, from which 10,000 oz. of gold was taken by crude methods, from a series of rich veinlets and pockets, almost at the surface. After the richest part of the bonanza had been worked out, a narrow but rich paystreak was exploited by the present company to a depth of over 300 ft., where it finally became too narrow and irregular for profitable working. Ore is crushed in a 10-stamp mill through 10-mesh screens. The resulting coarse pulp is then re-ground and the gold amalgamated in revolving Cobb pans. The tailing from the pans passes over James tables to remove the auriferous sulphides, and is then cyanided in steel tanks. The company is now in search of another property, so the mine is probably worked out.

Compania Anonima Minera Lo Increible. This is a Venezuelan corporation, with headquarters at Carácas. The mines, eight miles north-east from El Callao, are the result of a comparatively recent discovery. The hard quartz ore is crushed in a 20-stamp mill through 20-mesh diagonal-slot screens, the free gold being extracted by amalgamation. The average extraction from over 40,000 tons crushed to date is slightly in excess of ½ oz. per ton, about ¼ oz. remaining in the tailing. About 25,000 tons of tailing is now ready for cyanidation and the company is preparing to erect a plant to treat this residue as well as to handle the new tailing. Several veins are in process of exploitation and the future of the property is good.

New Callao Mining Co. This is the successor of the original El Callao, which was an English corporation. The present company, being a French organization, has been in trouble since the beginning of the War, as the necessary capital has been impossible to obtain. The main El Callao mine was abandoned and allowed to fill with water many years ago, but the property of this company is an extensive one, and embraces a number of other mines, some of them with excellent prospects.

The Cicapra district, which is situated about 25 miles north-west from El Callao, made a sensation some ten or fifteen years ago on account of the discovery of a succession of rich surface pockets of coarse gold, found almost under the grass-roots in the low hills bordering the banks of the Cicapra river, a branch of the upper Yuruári. The gold is in decomposed schist. A portion of this zone, including the bed and banks of the Cicapra river, is being explored by the Yuruári company, a Venezuelan corporation, with headquarters at Carácas. The operations, which as yet are of a preliminary character, are being carried on by means of a small clamshell dredge, with a capacity of 200 cu. yd. per day. The entire property of several hundred acres has been fairly well prospected by churn-drilling and several

million cubic yards of material is estimated to be available, with an average yield of $1 per yard, at a cost of 50c. per yard.

The Cuyuni and El Dorado districts of Spanish Guiana embrace the extreme south-eastern part of Venezuela, extending to the frontier of British Guiana. The

LO INCREIBLE 20-STAMP MILL

INTERIOR OF MILL

production is mainly from alluvial washings, although some gold is now being won from quartz veins.

The workings extend into the basin of the Cuyuni, which in turn runs into the main Esequibo river, the principal stream of British Guiana. Two French companies are operating in the district; they are known locally as the Cuyuni Company and the Perseverancia or El Dorado Company. In addition to these two ventures, a considerable quantity of gold, amounting in favorable seasons to several thousand ounces, is produced by primitive hand-washing in bateas and hand-rockers, from concessions belonging to private individuals, who grant permits to the miners, and exact a percentage of the gold produced as royalty. Altogether, this is a rich and promising district and may become of much greater importance when more favorable conditions prevail. At present the output is limited owing to lack of transportation, high cost of food and supplies, and the prevalence of malarial fevers. Beri-beri is also

ANOTHER VIEW OF THE INTERIOR

common, owing to the lack of vitamens in the food, which is chiefly milled rice.

With better facilities in the shape of dredges and other modern gold-saving machinery, as well as the construction of better roads from the Orinoco river, south-eastern Venezuela may easily take its place in the front rank as one of the most productive gold-mining districts of South America. This applies in equal proportion to the northern part, around El Callao. The entire district, with the exception of the immediate vicinity of El Callao, is fairly well timbered. The rivers and larger streams abound in water-power sites, and the country presents no unusual difficulties to the construction of good roads. The climate, while hot and damp in the rainy season, it not unhealthy for white men who observe the usual precautions necessary in all tropical countries.

Sampling and Analysis of Chromite

By ABBOT A. HANKS

Preparation of Samples. The sample sent to the assayer, if it represents either a shipment or a lot of ore extracted for shipment, should be taken so as to represent what it is intended to sample. It should weigh 40 to 60 lb., and contain no single piece larger than an egg. When this sample reaches the laboratory it should all be crushed through a rock-breaker, set to give a one-half inch product. The rock-breaker product should be thoroughly mixed and cut down with a riffle, a Jones divider, or similar sampler, to one-quarter of its original size. This quarter (10 to 12 lb.) should be put through laboratory rolls, set to give a product of 12 to 16-mesh. This roll-product should again be cut down to a sample of about one pound. The whole of this one-pound sample should be pulverized in a disc-grinder or similar machine to pass 100 or 150-mesh. Before making the analysis the pulp should be dried at 212°F. to constant weight.

Chromium

The analysis of chrome ore may be separated into the following operations:

Fusion in an iron crucible with sodium peroxide.

Dissolving the melt in water; filtering and making acid with sulphuric acid.

Adding an excess of ferrous ammonium sulphate and titrating with standard potassium permanganate solution.

The standard method is described in the following text-books:

'Technical Methods of Ore Analysis,' by A. H. Low.

'Standard Methods of Chemical Analysis,' by W. W. Scott.

'Principles of Quantitative Anelysis,' by W. C. Blasdale.

Weigh out ½ gram of 100 to 150-mesh product; place in a 20-cc. iron crucible; add 8 gm. sodium peroxide and mix thoroughly with a small glass rod; cover and slowly fuse over a Bunsen burner by slowly rotating over the flame for about five minutes; when complete, decomposition of the ore will result. When partly cool, transfer the crucible and the melt to a 400-cc. beaker containing 150 cc. to 200 cc. water. When action ceases, rinse the crucible and the cover, then boil the solution at least five minutes, then dilute to 350 cc. with hot water. When partly cool, filter on a Buchner funnel using suction and wash thoroughly with hot water. Dissolve the precipitate with dilute hydrochloric acid to determine if the fusion was complete. If not, start a new portion. Cool the filtrate, transfer to a 1000-cc. beaker and dilute to 500 cc. with cold water, and add 25 cc. sulphuric acid (2 to 1); add 50 cc. standard ferrous ammonium sulphate solution (which should be an excess), from an automatic pipette, to the solution in the beaker and then titrate with standard potassium permanganate solution. Standardization is accomplished by weighing ½ gm. of c.p. potassium chromate into a 1000-cc. beaker, dissolve in cold water, and make acid as above and proceed as explained; 50 cc. of the ferrous ammonium sulphate solution is titrated at least once each day by the potassium permanganate to determine their relative strength.

Potassium chromate equals 39.135% Cr_2O_3.

Ferrous ammonium sulphate solution contains 100 gm. ferrous ammonium sulphate crystals and 20 cc. sulphuric acid per litre.

Potassium permanganate solution contains 6.0 gm. c.p. $KMnO_4$ per litre.

Example:

50 cc. of ferrous ammonium sulphate solution equals 69.45 cc. $KMnO_4$.
One-half gram c. p. potassium chromate equals 26.25 cc. $KMnO_4$.

Then	69.45
	26.25
	43.20
	2
	86.40 cc.

$\frac{0.39135}{86.4} = 0.0045296$ gm. Cr_2O_3 = value of 1 cc. of $KMnO_4$.

Silica

One-half gram of ore is fused as above but with c. p. Na_2O_2; dissolve in 50 cc. water; rinse off the crucible and the cover; make acid with hydrochloric acid; and take to dryness twice as for silica determinations. Complete as usual for silica. Run a blank using the same amount of c. p. Na_2O_2 under the above conditions, and deduct any SiO_2 thus obtained from the SiO_2 found in the ore.

The Determination of Chromium in Chromite

The following rapid method is in use at the Berkeley Experiment Station of the U. S. Bureau of Mines:

The ore should be ground to 100-mesh. Weigh out 0.5 gm. sample and brush into a 20-cc. spun-iron crucible in which has previously been placed 4 to 5 gm. of fresh Na_2O_2 (technical grade is satisfactory). Mix well with a glass rod, cover with a little Na_2O_2, and fuse at a low-red heat. After the charge has melted it should remain in the molten condition for five minutes. Allow the crucible to cool, place in a 600-cc. beaker of pyrex or other low-expansion glass or in a large casserole; add water and digest until the fused mass has disintegrated, after which remove and rinse the crucible. Boil for 10 minutes to decompose the Na_2O_2. Without filtering,

neutralize the solution with 1–4 H_2SO_4 or 1–1 HCl and add 25 to 30 cc. excess. Dilute to approximately 400 cc., cool and titrate with a standard solution (about 0.2 N) of $FeSO_4$. Add a slight excess of $FeSO_4$ solution, as shown by spot-plate tests with a 1% solution of $K_3Fe(CN)_6$, and finish the determination by back-titration with standard $K_2Cr_2O_7$ solution. The $FeSO_4$ solution may be added rapidly without great care, as the approximate end-point is readily recognized by the color-change of the solution. With a little practice two or three spot-tests should be sufficient to determine the exact end-point.

Notes: The quickness of this method is due largely to the omission of filtration before acidifying the dissolved fusion. Manganese is practically the only interfering substance found in Western ores, and when this is present filtration is necessary.

The initial alkaline solution containing the precipitate inclines to bump on boiling. A few chips of fresh unglazed porcelain or a stirring-rod with roughened end, placed opposite one of the points where the beaker makes contact with the hot plate, minimizes this difficulty.

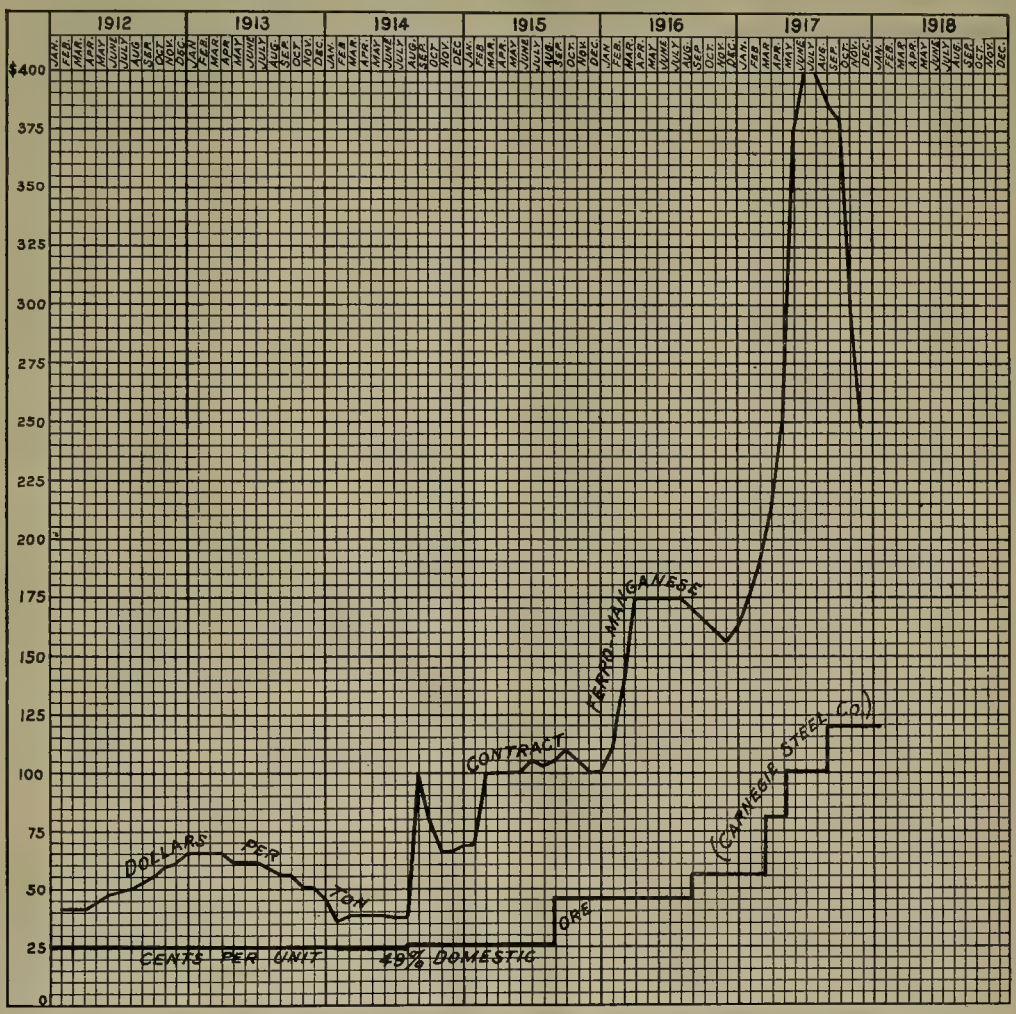
The standard $FeSO_4$ solution is prepared by dissolving 56 to 60 gm. $FeSO_4 \cdot 7H_2O$ in about 800 cc. distilled H_2O, to which has been added 100 cc. concentrated H_2SO_4. After cooling, the solution is diluted to one litre. The 0.2 N $K_2Cr_2O_7$ solution may be made by dissolving 9.806 gm. c.p. $K_2Cr_2O_7$ in one litre. The $FeSO_4$ solution may be standardized with a standard $KMnO_4$ solution based on Bureau of Standards sodium oxalate or against the $K_2Cr_2O_7$ solution, provided this was made from a salt of known purity.

One cubic centimetre of 0.1 N solution is equivalent to 0.001733 gm. Cr, or 0.002532 gm. Cr_2O_3.

Manganese and Pyrite

[We quote herewith part of the supplementary testimony given by Philip N. Moore before the Committee on Mines and Mining of the U. S. Senate, because it lays emphasis on a point that should not be overlooked at this time.—EDITOR.]

The element of time in the matter of supply and demand under these war conditions is of such weight that the usual results of supply and demand fail to follow. The minerals mostly affected by this bill, namely, pyrite and manganese, exist in the United States in relatively small bodies, mostly owned by individuals, and not corporately controlled in units, and under normal conditions



PRE-WAR AND WAR PRICES FOR MANGANESE ORE AND FERRO-MANGANESE

unable to operate, partly due to the much larger and cheaper supply obtainable from abroad, and partly due to the fact that manufacturing industry is controlled while the producing is not. In my testimony before the House committee upon this bill, I alluded to one instance of the difference in price between the manganese alloys and manganese ores, a chart for which had been worked out by Mr. Hewitt of the U. S. Geological Survey. This chart shows what is the normal condition of affairs in the manganese ore industries in pre-war times; it covers the market-price from 1912 to the present time. Due to the fact that there was only one large manufacturer of manganese alloys in the United States, the price per unit for manganese or domestic ore has been kept practically at one stable level for four years, while the price of the alloy varied greatly with, at times, an excessive spread between the ore and the alloy. That spread varies excessively, and in the last two years has been very great, allowing an excessive profit on the manufacture. That can be controlled. The spread will doubtless now, under the inhibition of foreign imports, diminish, but it is a condition which under the highly controlled manufacturing system can only be affected by the hand of governmental power. Supply and demand will affect it for a time, but there again the element of time comes in, and you may see a sudden spurt, a high price for manganese ore, which will possibly be so high that the margin of profit will be slight, but in the end, as long as the manufacture is controlled, and there is no governmental control of price, that unstable and unfair condition will obtain.

With respect to pyrite, there are concrete instances, which I shall be glad to have go on the record, why development would proceed if the consumer of pyrite ore, and the manufacturer of acid, were not able to control the market himself and refuse a fair price, or, which is just as bad, refuse a time contract. At the present time certain parties are estimating and figuring seriously on the construction of a plant in our Western coalfields to produce pyrite ore by concentrating the pyrite waste from the coal mine, which is very large. There are thousands of tons of pyrite going to waste in our Illinois, Indiana, and Kentucky coalfields today, absolutely unsaved, a large portion of which might be utilized at a guaranteed price. The gentlemen who are planning this work know what they can do in the treatment and know what their cost will be, and know approximately what they can get the raw material for; but the acid-burners, so far, have been unwilling to give them any time contracts at satisfactory figures. The acid-burner has been accustomed to deal with many small pyrite producers or to use sulphur from our Texas and Louisiana fields, and he has had a certain domination over the small pyrite producer, such as a manufacturer always has. In my judgment, nothing except Government control can handle that situation and stimulate the production to the degree which is needed. We are up against an impending shortage of pyrite, which is going to require either long-haul supply from the Rocky Mountains, which in turn will consume rolling-stock and time and money, or some time guaranty which will bring the stuff out from the East. Supply and demand is a mighty good horse on a long race, but when he meets the impediments of war and danger he is apt to be outclassed by emergency.

Oil in San Francisco

About the first of October, the California State Board of Harbor Commissioners began an excavation for a reinforced concrete oil-storage tank on a lot at the corner of Battery street and the Embarcadero, San Francisco. As this is filled land, and only about 200 feet west of the San Francisco sea-wall, it is usual to strike water at a depth of about six feet. Accordingly when the excavation neared this depth, a small centrifugal pump was installed to take care of the water. After the pump had been in operation for a few hours, the foreman of the job was much surprised to find that the pump was delivering a stream of almost straight oil, and a great deal of excitement was created along the water-front. Reports went broadcast that the State Board of Harbor Commissioners had brought in an oil-well almost in the heart of San Francisco. About the same time, some workmen engaged on work for the State in excavating for concrete piles, about four blocks north, also struck a small amount of oil. This increased the excitement and repeated inquiries came to the office of the U. S. Bureau of Mines in the Custom House for an explanation of the occurrence of oil in paying quantities in San Francisco. The matter has been investigated by one of the members of the Bureau, and it has been found that all the claims made for the discovery of oil at the corner of Battery and the Embarcadero in paying quantities are true. For the first four days after the oil was discovered, it was being pumped from the excavation at the rate of about 120 bbl. per day and since that time approximately 1500 bbl. of oil has been recovered. The oil has a gravity of 18° B., and is now being used in the locomotives of the State Belt Line.

Investigation has shown that at the time of the fire and earthquake in 1906, there were several large oil-storage tanks about five blocks north of the point where the excavation was made. These tanks were all on filled ground. At least one of them, which is said to have had a capacity of 37,000 bbl., was ruptured at the time of the earthquake by the ground settling under it, and a large amount of the contents presumably seeped in the porous fill, which was composed largely of brickbats, rubbish, rock, etc., before the fire reached this point, about two days later. Undoubtedly, this is the oil that is now being recovered.

The instance is worthy of note in that it tends to show in a measure the action of water on oil in underground strata. The sea-wall running along the easterly line of the Embarcadero has kept the oil from getting out into the Bay. The solid formation of Russian hill to the west has kept it from going down, so its migrations are limited to a comparatively narrow north and south strip in the vicinity of the Embarcadero.

THE S. A. T. C. AT COLUMBIA UNIVERSITY SUBSCRIBING TO LIBERTY BONDS

Columbia University in War-Time

Herewith we publish a photograph that will gladden the hearts of Columbian graduates and interest others. It shows the response of the 3000 members of the Student's Army Training Corps when asked to subscribe to Liberty bonds. The order came, "All men who will subscribe to a Liberty bond hold up your hands!" The response is shown. They subscribed $200,000 on the spot.

THE WAR TRADE BOARD has introduced restrictions on the importation of tin in order to give effect to the regulation of the distribution of tin and tin ores, concentrates, and derivatives under the Tin Executive recently established in London. All outstanding licenses for the importation of pig tin, tin ore, and tin concentrates, and, or, any chemical extracted therefrom, have been revoked as to ocean shipment from abroad after October 20, 1918. Hereafter no licenses will be issued for the importation of these commodities except to cover shipments consigned to the United Steel Products Company.

THE ELECTRIC-POWER LOAD in an oilfield is considered to be an ideal one for a central station; that is, the power-factor is high. The load is practically constant 24 hours per day, for every day.

BETTER ILLUMINATION is necessary for all-night work than where the artificial lighting is used for only an hour or two per day.

Production of Gold and Silver in the United States During 1917

The Bureau of the Mint and the U. S. Geological Survey have issued the following joint final statement of the production of gold and silver in the United States during the calendar year 1917:

	Gold		Silver	
State or Territory	Ounces	Value	Ounces	Value
Alaska	709,729	$14,671,400	1,207,164	$994,100
Alabama	106	2,200	.....	.....
Arizona	250,613	5,180,600	6,962,257	5,733,400
California	1,012,461	20,929,400	2,107,107	1,735,200
Colorado	772,766	15,974,500	7,291,495	6,004,500
Georgia	314	6,500	.....	.....
Idaho	36,511	754,800	11,402,542	9,390,000
Illinois	.....	.....	7,116	5,900
Maryland	.....	.....	538	400
Michigan	.....	.....	684,225	563,400
Missouri	15	300	63,344	52,200
Montana	177,690	3,673,200	14,555,034	11,986,100
Nevada	335,361	6,932,500	11,217,654	9,237,700
New Mexico	52,505	1,085,400	1,535,807	1,264,700
North Carolina	524	10,800	590	500
Oregon	81,624	1,687,300	172,152	141,800
Philippine Islands	69,953	1,446,100	12,715	10,500
Porto Rico	5	100	.....	.....
South Carolina	82	1,700	.....	.....
South Dakota	356,662	7,372,900	190,382	156,800
Tennessee	267	5,500	106,975	88,100
Texas	5	100	587,945	484,200
Utah	170,383	3,522,100	13,360,905	11,002,700
Vermont	5	100	403	300
Virginia	63	1,300	4,500	3,700
Washington	23,617	488,200	266,112	219,100
Wyoming	179	3,700	3,400	2,800
Total	4,051,440	$83,750,700	71,740,362	$59,078,100

Compared with the production in 1916—gold $92,590,300, and silver 74,414,802 fine ounces—these figures indicate a reduction in the output of gold of $8,839,600 and in the output of silver of 2,674,440 fine ounces.

Copper Distribution in Mexico

The accompanying map of Mexico indicates by heavy dots the situation of the copper mines of the Republic that have been developed beyond the prospect stage. It was prepared by Luis C. Espinosa, as consulting engineer and chairman of the Technical Commission charged by the Carrancista government with the duty of making a report upon the iron and copper resources of Mexico, and was published as a large map accompanying the 'Boletin Minero' for May-June 1918. A list of the mines was also given, classified by States. No technical information, however, was included. The following table of production, by States, for 1917, will be of interest in connection with the map.

For comparison it may be pointed out that this is a trifle less than the production of copper in the United States in 1890, and 11.2% of the output last year, which amounted to 1,886,000,000 lb. The grouping of the deposits is interesting. There are eight areas. The Baja Californian and Sonoran extend in long zones bearing slightly east of south. Each of the others represents a grouping about a common centre. The deposits in the north-western areas generally carry but small quantities of gold and silver.

MAP OF MEXICO, SHOWING DISTRIBUTION OF COPPER DEPOSITS

Mexican Copper Production in 1917

State	Pounds
Aguascalientes	9,616,854
Baja California	20,295,000
Coahuila	1,416,800
Nuevo Leon	183,365,000
Sonora	68,396,865
San Luis Potosí	1,244,298
Zacatecas	26,918,309
Total	211,253,126

Calculating Traverses Without Tables

By A. J. SALE

In problems involving calculations, the most prevalent cause of failure is mathematical cowardice, which means giving up before a thorough attempt has been made. I believe that, in the primary teaching of any subject, the instructor achieves better results by concentrating his energy upon the encouragement of self-confidence in the pupil than by devoting too much time to the subject itself. It is surprising how rapidly the average person can grasp the principles of any science, if properly trained to self-confidence. I have taught many men, with only a grade-school education, to use the slide-rule, logarithmic tables, simple algebra, and even primary calculus, and invariably the principal difficulty lay in convincing them that they could easily learn what was being explained to them. Personally, I would like to see the metric system taught in the kindergarten, algebra in the third grade, and calculus in the seventh, but, within the last 20 years, the tendency has been to decrease rather than increase the mathematical training. The result is that, in the most serious crisis which the nation has ever faced, and one in which mathematics are the essence of success, we find the average American with but little training along these lines. How many of us can instantly grasp the meaning of 20 kilometres? To some it will not convey any idea; others will say it is about 10 miles, while a few can figure (20 by 1000) by 39.37 = 787,400 in., or 65,617 ft. = 12.4 miles. But this figuring takes time, and then does not give the information which thinking in the metric system would accomplish.

In the following descriptions, in order to make the work complete, I touch briefly upon many branches of mathematics; but I believe that this article will be perfectly clear to the average engineer, provided he has sufficient bravery not to be frightened at the methods involved. While writing this paper, I am in an isolated camp without any reference-books or tables whatsoever, so I may appear to enter into more detail than is necessary; but, as the purpose is to explain how any kind of surveying problem can be solved without the use of tabulated information, it requires some unusual detail. If any other engineer will lock himself in a room with nothing but pencil and paper, and attempt to figure the closing line of a traverse, I venture that he will have to resort to considerable preliminary calculation.

I will not take time by explaining the derivation of the formulas $\text{Sin}\ (U+V) = \text{Sin}\ U \times \text{Cos}\ V + \text{Cos}\ U \times \text{Sin}\ V$ or $\text{Cos}\ (U+V) = \text{Cos}\ U \times \text{Cos}\ V + \text{Sin}\ U \times \text{Sin}\ V$; but Fig. 1, representing a circle of unit radius, is all that is necessary to derive them. Also Fig. 2 is used in like manner to derive the formulas $\text{Sin}\ (U-V) = \text{Sin}\ U \times \text{Cos}\ V - \text{Cos}\ U \times \text{Sin}\ V$; and $\text{Cos}\ (U-V) = \text{Cos}\ U \times \text{Cos}\ V + \text{Sin}\ U \times \text{Sin}\ V$. If the reader will take these sketches and personally work out these derivations without looking in a handbook for an explanation, he will find that they will be strongly impresesd upon his memory after so doing.

Having derived the above formulas, it is an easy matter to obtain: $\text{Sin}\ (2U) = 2\ \text{Sin}\ U \times \text{Cos}\ U$, and $\text{Cos}\ (2U) = \text{Cos}^2\ U - \text{Sin}^2\ U = 1 - 2\ \text{Sin}^2\ U$, from which $\text{Cos}\ U = 1 - 2\ \text{Sin}^2\ (U/2)$.

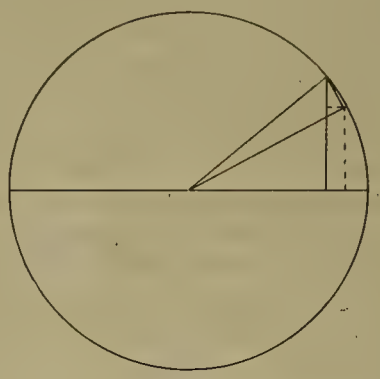


Fig. 1

The above are the most essential formulas for the work that I am about to describe, but sometimes it will save time to use: $\text{Sin}\ (3U) = \text{Sin}\ (2U+U)$, which can be reduced to $3\ \text{Sin}\ U - 4\ \text{Sin}^3\ U$; and $\text{Cos}\ (3U) = \text{Cos}\ (2U+U)$, which can be reduced to $4\ \text{Cos}^3\ U - 3\ \text{Cos}\ U$.

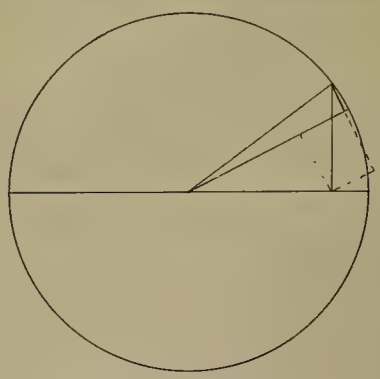


Fig 2

For work of this kind, after deriving the primary trigonometric formulas, it will be necessary to review a

few points in higher algebra. One of these is the binomial theorem:

$$(X+Y)^n = X^n + N\cdot X^{(n-1)} \times Y + \frac{N(N-1)}{1\times 2} \times X^{(N-2)}\cdot Y^2 + \ldots.$$

This can easily be worked by starting with $(X+Y)^2$, $(X+Y)^3$, etc., until the mind grasps the entire series. The principal use for this formula is in the study of errors in such a function as

$$\sqrt{1+A} = (1+A)^{\frac{1}{2}} = 1 + \tfrac{1}{2}A - \tfrac{1}{8}A^2 + \tfrac{1}{16}A^3 \ldots.$$

If A is very small, it can be discarded beyond the first power, for reasonably accurate work; while, for greater accuracy, $\sqrt{1+A}$ can be taken as $1 + \frac{1}{2}A - \frac{1}{8}A^2$.

For instance, $\sqrt{1.21} = \left(1 + \frac{21}{100}\right)^{\frac{1}{2}}$ gives 1.09949 instead of 1.10.

It is also sometimes convenient to understand the solution of an equation of the form $AX^3 + BX^2 + CX + D = 0$.

The first operation is to divide by A, and obtain the form $X^3 + EX^2 + FX + G = 0$.

Next, let $X = Y - \frac{1}{3}E$, which gives the form $Y^3 + HY + I = 0$.

Now replace Y by two variables, P and Q. Since we are replacing by two variables, we require two governing conditions. Let these conditions be $Y = P + Q$, and $P^3 + Q^3 = -I$.

From which we have $Y^3 = (P+Q)^3 = P^3 + Q^3 + 3P^2Q + 3PQ^2 = (P^3 + Q^3) + 3PQ(P+Q)$.

$HY = H(P+Q) = H(P+Q)$.

$I = I = I$.

$Y^3 + HY + I = (P^3 + Q^3) + I + (P+Q)\ (3PQ + H)$.

But, $Y^3 + HY + I = 0$; and $(P^3 + Q^3)$ was taken $= -I$.

Therefore $(P+Q)\ (3PQ + H) = 0$.

Dividing by $(P+Q)$, $3PQ + H = 0$; or $PQ = -\frac{1}{3}H$.

Cubing this equation, $P^3Q^3 = -1/27H^3$.

And we have already taken $(P^3 + Q^3) = -I$.

Now let $P^3 = U$, and $Q^3 = V$.

Then $U + V = -I$; $UV = -1/27H^3$.

The above can be solved by quadratic equations for U and V; from which P and Q can be obtained; which will give us the value of Y; finally the value of X.

Even without the solution of the cubic equation we could proceed with the calculation of any traverse; but we would be in the dark as to probable errors, which forces us into calculus. I have seen engineers of high ability stand in horror at the mention of even differential calculus, but, in fact, this is a very simple branch of mathematics. All that is necessary in order to remember primary calculus is to bear in mind that the differential of any function is the effect caused by an infinitely small change. For instance, to obtain $d\,X^2$, let M represent an infinitely small amount. Then $(X+M)^2 = X^2 + 2XM + M^2$; and $(X+M)^2 - X^2 = +2XM + M^2$. But, since M was assumed to be infinitely small, all powers beyond the first can be discarded, leaving $2XM$. But $(X+M)^2 - X^2$ represents the change in the function X^2 due to the infinitely small change M, which we call $d,\ X$. Hence $d,\ X^2 = 2X(dX)$. In the same way it can be shown that for any power

$$d,\ X^n = N\cdot X^{(N-1)} \times (d,\ X)$$

The simple integral is the result of noting what function can be differentiated to give the function the integral of which is sought. For instance, it can be seen at a glance that $\int 2X \times (d,\ X)$ is X^2, but it must be borne in mind that, since the differential of a constant is zero, there must be a constant, K, added to the integral. That is for the above case $\int 2X\ (d,\ X) = X^2 + K$. The value of K must be determined from other data. By remembering the primary principle, any ordinary differential can be worked out. Take, d, Sin U; Sin $(U+M)$ = Sin U $\times$ Cos M + Cos $U \times$ Sin M. Since M is infinitely small, Cos $M = 1$ and Sin M can be taken as M, making Sin $(U+M)$ = Sin $U + M$ Cos U and Sin $(U+M)$ − Sin $U = M$ Cos U; or d, Sin $U = +$ Cos U $(d,\ U)$. In like manner it can be shown that d, Cos $U = -$ Sin U $(d,\ U)$. The second differentiation of a function is applied the same as the first, and so on. Take any function of X, which we will call

$$F(X) = A + BX + CX^2 + DX^3 + EX^4 + FX^5 + GX^6 + \ldots\ldots$$

By successive differentiation we obtain:

$d,\ F(X) = (B + 2CX + 3DX^2 + 4EX^3 + 5FX^4 + 6GX^5 + \ldots\ldots)d,\ X.$

$d_2,\ F(X) = (2\times 1C + 3\times 2DX + 4\times 3EX^2 + 5\times 4FX^3 + 6\times 5GX^4 + \ldots\ldots)d,\ X.$

$d_3,\ F(X) = (3\times 2\times 1D + 4\times 3\times 2EX + 5\times 4\times 3FX^2 + 6\times 5\times 4GX^3 + \ldots\ldots)d,\ X.$

$d_4,\ F(X) = (4\times 3\times 2\times 1E + 5\times 4\times 3\times 2FX + 6\times 5\times 4\times 3GX^2 + \ldots\ldots)d,\ X.$

$d_5,\ F(X) = (5\times 4\times 3\times 2\times 1F + 6\times 5\times 4\times 3\times 2GX + \ldots\ldots)d,\ X.$

$d_6,\ F(X) = (6\times 5\times 4\times 3\times 2\times 1G + \ldots\ldots)d,\ X;$ and so on.

Now if we make $X = 0$ in each of these functions we see that

$F(X_0) = Ad,\ X.$

$d,\ F(X_0) = Bd,\ X.$

$d_2,\ F(X_0) = 2\times 1\,C\,d,\ X.$

$d_3,\ F(X_0) = 3\times 2\times 1Dd,\ X.$

$d_4,\ F(X_0) = 4\times 3\times 2\times 1Ed,\ X.$

$d_5,\ F(X_0) = 5\times 4\times 3\times 2\times 1Fd,\ X.$

$d_6,\ F(X_0) = 6\times 5\times 4\times 3\times 2\times 1Gd,\ X,$ and so on.

From which,

$A = F(X)_0.$

$B = d,\ F(X)_0.$

$C = \frac{1}{2\times 1}\ d_2,\ F(X)_0.$

$D = \frac{1}{3\times 2\times 1}\ d_3, F(X)_0.$

$E = \frac{1}{4\times 3\times 2\times 1}\ d_4, F(X)_0.$

$F = \frac{1}{5\times 4\times 3\times 2\times 1}\ d_5, F(X)_0.$

$G = \frac{1}{6\times 5\times 4\times 3\times 2\times 1}\ d_6, F(X)_0,$ and so on.

Applying this law, to find the Sine function:

$\text{Sin } 0 = 0.$

$d,\ \text{Sin}_0 = \text{Cos}_0 = +1.$

$d_2,\ \text{Sin}_0 = d,\ \text{Cos}_0 = -\text{Sin}_0 = 0.$

$d_3,\ \text{Sin}_0 = d,\ (-\text{Sin})_0 = -\text{Cos}_0 = -1.$

$d_4,\ \text{Sin}_0 = d,\ (-\text{Cos})_0 = \text{Sin}_0 = 0.$

$d_5,\ \text{Sin}_0 = d,\ (\text{Sin})_0 = \text{Cos}_0 = +1,$ and so on.

From which we note

$A = 0$

$B = -1.$

$C = 0.$

$D = -1 \times \frac{1}{3 \times 2 \times 1}$

$E = 0.$

$F = +1 \times \frac{1}{5 \times 4 \times 3 \times 2 \times 1}$, and so on.

Which demonstrates that the Sine function is $\text{Sin } U = U - \frac{1}{3 \times 2 \times 1} U^3 + \frac{1}{5 \times 4 \times 3 \times 2 \times 1} U^5 - \ldots\ldots$

In like manner, it can be demonstrated that the Cosine function is, $\text{Cos } U = 1 - \frac{1}{2 \times 1} U^2 + \frac{1}{4 \times 3 \times 2 \times 1} U^4 - \frac{1}{6 \times 5 \times 4 \times 3 \times 2 \times 1} U^6 + \ldots\ldots$

These series will prove of great service, and they are worth remembering.

If we take the function $1 + X + \frac{1}{2 \times 1} X^2 + \frac{1}{3 \times 2 \times 1} X^3 + \frac{1}{4 \times 3 \times 2 \times 1} X^4 + \ldots\ldots$ and replace X by $\sqrt{-1} \times U$, called iU, we find $1 + iU - \frac{1}{2 \times 1} U^2 - \frac{1}{3 \times 2 \times 1} iU^3 + \frac{1}{4 \times 3 \times 2 \times 1} U^4 + \frac{1}{5 \times 4 \times 3 \times 2 \times 1} iU^5 - \ldots\ldots$

By segregating we obtain

$$\left(1 - \frac{1}{2 \times 1} U^2 + \frac{1}{4 \times 3 \times 2 \times 1} U^4 - \ldots\ldots\right) + i\left(U - \frac{1}{3 \times 2 \times 1} U^3 + \frac{1}{5 \times 4 \times 3 \times 2 \times 1} U^5 - \ldots\ldots\right)$$

which we can see is $\text{Cos } U + i \text{ Sin } U$. This is the best way to remember how to derive the Sine and Cosine series, as it is easy to remember the original series; and, since there is an i in Sin, it makes a natural combination.

Before leaving calculus, we will use it to give us the value of the ratio of the circumference of a circle to its diameter, usually expressed as 3.1416 or 3.14159, which, in the absence of all tabular data, might be forgotten. We have already shown how we get $d,\ \text{Sin } U = \text{Cos } U\ (d, U)$ and $d,\ \text{Cos } U = -\text{Sin } U\ (d, U)$. Next, let us consider $d,\ XY;\ (X + M)\ (Y + N) = XY + XN + YN + MN$, from which we can discard MN as the product of two infinitely small quantities, leaving $XN + YN$, or $d,\ XY = X\ (d, Y) + Y\ (d, X)$.

For $d,\ (\frac{1}{X});\ \frac{1}{(X + M)} = \frac{1}{X} - \frac{M}{X^2} + \frac{M^2}{X^3} - \frac{M^3}{X^4} + \ldots\ldots$

Discarding the higher powers of M, we find

$$\frac{1}{(X + M)} - \frac{1}{X} = -\frac{M}{X^2}.$$

Or, $d,\ (\frac{1}{X}) = -\frac{1}{X^2}\ (d, X)$

From which $d,\ (\frac{X}{Y}) = \frac{1}{Y}\ (d, X) - \frac{X}{Y^2}\ (d, Y).$

Therefore $d,\ \text{Tan } U = d,\ (\frac{\text{Sin } U}{\text{Cos } U}) = \frac{1}{\text{Cos } U}\ (d, \text{Sin } U) - \frac{\text{Sin } U}{\text{Cos}^2 U}\ (d, \text{Cos } U) = \frac{1}{\text{Cos } U} \times \text{Cos } U\ (d, U) - \frac{\text{Sin } U}{\text{Cos}^2 U}\ (-\text{Sin } U)\ (d, U) = (1 + \frac{\text{Sin}^2}{\text{Cos}^2 U})(d, U)\ \frac{1}{\text{Cos}^2 U}\ (d, U).$

Now take the function $Y = \text{Tan}^{-1} X$, meaning Y is an angle whose tangent is X; or $X = \text{Tan } Y$.

Differentiating both sides of the last equation, $d,\ X = d,\ \text{Tan } Y = \frac{1}{\text{Cos}^2 Y}\ (d, Y) = (1 + \text{Tan}^2 Y)\ (d, Y) = (1 + X^2)\ (d, Y).$

Or, $d,\ Y = \frac{1}{(1 + X^2)}\ (d, X) = (d, X)\ (1 - X^2 + X^4 - X + \ldots\ldots)$

Integrating both sides of this equation: $Y = X - 1/3X^3 + 1/5X^5 - 1/7X^7 + \ldots\ldots + K.$

But, since $Y = 0,\ X = 0,$ making $K = 0.$

Now consider the angle 45° or $\frac{\pi}{4}$, whose tangent is 1, (setting $X = 1$ in the above equation), $\frac{\pi}{4} = 1 - 1/3 + 1/5 - 1/7 + 1/9 - 1/11 + \ldots\ldots$

Or $\pi = 4(1 - 1/3 + 1/5 - 1/7 + 1/9 - 1/11 + \ldots\ldots)$

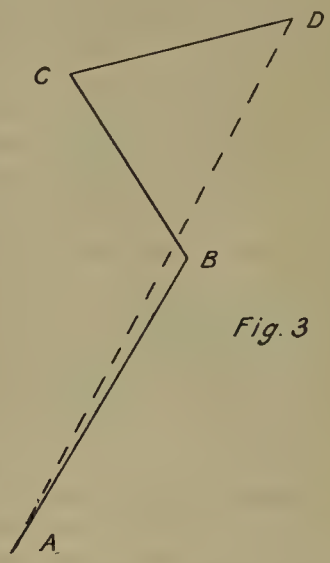


Fig. 3

Which can be reduced to $\pi = 8(1/3 + 1/35 + 1/99 + 1/195 + 1/325 + \ldots\ldots).$

Before completing the preliminary study it is advisable to grasp the theory of uniform accuracy. Anyone can understand that it would be foolishness to run part of a traverse with stadia, and another part with steel tape, using spring balances and thermometers, but I have seen engineers of considerable experience do practically the same thing in using traverse tables by stringing out their figures all the way across a sheet of paper, when the final ones could have been dropped at one or two places. In calculations involving distances and bearings, it stands to reason that, for uniform accuracy, it is only necessary to be 1/100 as accurate with a bearing controlling a 10-ft. distance as it would be with one controlling 1000 ft. The same rule applies to the multiplication of large fractions. Let $A + C$ represent a large decimal fraction, of which

A is the beginning and C the finishing portion. In the same way let $B + D$ represent another. By multiplying them together we find $(A + C)\ (B + D) = AB + AD + BC + CD$. Now, since the problem is the question of discarding both C and D, it is evident that CD will be too small to enter into the discussion, leaving $AB + AD + BC$. Now, if we had discarded both C and D at the start, the result would be AB, with a consequent error of $AD + BC$. If our allowable error is E, and E is greater than $AD + BC$, we can write $(A + C)\ (B + D) = AB$. As an example: Suppose we are working with an allowable error of 1 in the fourth decimal place, and we have to multiply 0.08123 by 0.05612, we can see at a glance that $0.00023 \times 0.056 + 0.00012 \times 0.081$ is under 0.0001, allowing us to write 0.081×0.056. In this new expression we see that 0.006×0.081 is more than 0.0001, but we also see that 0.001×0.056 is less than 0.0001. Which allows us to write $0.08 \times 0.56 = 0.00448$, which, to preserve uniform accuracy, we will call 0.0045. If we actually multply 0.05612×0.08123 we obtain 0.00455+, called 0.0046, within our limit of allowable error. The immense amount of labor saved by this method is very important. In work where great accuracy is required I usually assume my allowable error at 1/10 its actual amount, to cover the accumulation of minor errors. In this kind of work it is better to make multiplication from the left-hand side, so as to observe when the line of necessary accuracy has been crossed. It is also apparent that the rule of casting out 9s will prove of value in checking the arithmetic.

We are now prepared for basic calculations. The primary functions at the start are the Sine and Cosine of 45°, 60°, and 30°; also the Sine of 1 minute. In case one does not remember, an isosceles right-triangle with unit hypotenuse will demonstrate both Sin 45° and Cos 45° to be $\frac{1}{2}\sqrt{2} = 0.70711$. While a bisected equilateral triangle will show Sin $60° = \frac{1}{2}\sqrt{3} = 0.86603$; Cos $60° = \frac{1}{2}$; Sin $30° = \frac{1}{2}$; and Cos $30° = \frac{1}{2}\sqrt{3} = 0.86603$. For Sin 1′, we will assume that it is identical with the arc-value of 1′, in a circle of unit radius. This value is $\frac{2\pi}{360 \times 60} = \frac{6.28318}{21600} = 0.0002909$. If we apply this value in the function $\text{Sin } U = U - \frac{1}{3 \times 2 \times 1} U^3 + \frac{1}{5 \times 4 \times 3 \times 2 \times 1} U^5 - \ldots\ldots$, we see that, to take it as Sin 1′, will give us practically perfect results.

For 15°: Sin $15° = \text{Sin } (45° - 30°) = \text{Sin } 45° \times \text{Cos } 30° - \text{Cos } 45° \times \text{Sin } 30° = (\frac{1}{2}\sqrt{2})\ (\frac{1}{2}\sqrt{3}) - (\frac{1}{2}\sqrt{2})\ (\frac{1}{2}) = \frac{1}{4}\sqrt{6} - \frac{1}{4}\sqrt{2} = 0.25882$. Cos $15° = \text{Cos } (45° - 30°) = \text{Cos } 45° \times \text{Cos } 30° + \text{Sin } 45° \times \text{Sin } 30° = (\frac{1}{2}\sqrt{2})\ (\frac{1}{2}\sqrt{3}) + (\frac{1}{2}\sqrt{2})\ (\frac{1}{2}) = 0.965925$.

As a check against these figures, Sin $(2U) = 2 \text{ Sin } U \times \text{Cos } U$; from which $\frac{1}{2} = \text{Sin } 30° = 2 \times 0.25882 \times 0.965925 = 0.50000+$.

For 7° 30′: Sin $(7\frac{1}{2}°) = \text{Sin } (\frac{1}{2} \times 15°)$. Now Cos $U = 1 - 2 \text{ Sin}^2 (\frac{1}{2}U)$. Hence $\text{Sin}^2 (\frac{1}{2}U) = \frac{1}{2}(1 - \text{Cos } U)$. From which, Sin $(\frac{1}{2}U) = \sqrt{\frac{1}{2}(1 - \text{Cos } U)}$; also Cos $(\frac{1}{2}U) = \sqrt{1 - \text{Sin}^2(\frac{1}{2}U)} = \sqrt{1 - \frac{1}{2}(1 - \text{Cos } U)}$. Therefore Sin $(7\frac{1}{2}°) = \sqrt{\frac{1}{2}(1 - \text{Cos } 15°)} = \sqrt{0.0170375} = 0.13053$; and Cos $(7\frac{1}{2}°) = \sqrt{1 - \frac{1}{2}(1 - \text{Cos } 15°)} = \sqrt{0.9829625} = 0.99144$.

As a check: $0.25882 = \text{Sin } 15° = 2 \text{ Sin } (7\frac{1}{2}°) \times \text{Cos } (7\frac{1}{2}°) = 2 \times 0.13053 \times 0.99144 = 0.25882+$.

We could apply the formulas for Sin $(3U)$ and Cos $(3U)$ and, by solving the cubic equation, we could get direct values for Sin 5° and Cos 5°; but this is too much work; and we will take 3° 45′ or $3\frac{3}{4}°$ as our final basic angle. Sin $(3\frac{3}{4}°) = \text{Sin } (\frac{1}{2} \times 7\frac{1}{2}°)$.

Hence Sin $(3\frac{3}{4}°) = \sqrt{\frac{1}{2}(1 - \text{Cos } 7\frac{1}{2}°)} = \sqrt{0.00428} = 0.06542$.

And Cos $(3\frac{3}{4}°) = \sqrt{1 - \frac{1}{2}(1 - \text{Cos } 7\frac{1}{2}°)} = \sqrt{0.99572} = 0.99785$.

As a check: Sin $(7\frac{1}{2}°) = 0.13053$, and $2 \times 0.06542 \times 0.99785 = 0.13055+$.

It will usually not pay to bother with $3\frac{3}{4}°$, unless angles near its size occur in several different places.

This completes all basic determinations, and we will derive the functions of other angles from the formulas for Sine and Cosine of $U \pm V$. The Cosine of very small angles can be taken as unity; and we can assume the Sine to be the number of minutes in the angle, times 0.0002909.

To determine where this rule ends, take the function $\text{Sin } U = U - \frac{1}{3 \times 2 \times 1} U^3 + \frac{1}{5 \times 4 \times 3 \times 2 \times 1} U^5 \ldots\ldots$, and let M = the number of minutes in angle U. Then 0.0002909 M is the numeric value of U.

Setting this value into our formula, we find $\text{Sin } U = U - 4.1028 \times 10^{-12} \times M^3 + \ldots\ldots$

And $U - \text{Sin } U = +4.1028 \times 10^{-12} \times M^3 - \ldots\ldots$, which is the amount of error in excess of the true Sine. For ordinary purposes we can drop the remainder of the series.

If our maximum error is to be $0.0001 = 10^{-4}$, we see that $0.0001 = +4.1028 \times 10^{-12} M^3$.

Or $M^3 = \frac{10^{-4}}{4.1028 \times 10^{-12}} = 24.4 \times 10^6$; from which $M = 100 \sqrt[3]{24.4} = 290$ minutes, which is practically 5°.

This shows us that, for an accuracy of 0.0001, we can break to the nearest 5° for the Sine; and if over 2° 30′, we should subtract 0.0001 from 0.00029M for the exact Sine.

For the Cosine, take the formula $\text{Cos } U = 1 - \frac{1}{2 \times 1} U^2 + \frac{1}{4 \times 3 \times 2 \times 1} U^4 - \ldots\ldots$

Setting in the value of $U = 0.0002909M$, we obtain $\text{Cos } U = 1 - 4.234 \times 10^{-8} \times M^2 + \ldots\ldots$

And $1 - \text{Cos } U = +4.234 \times 10^{-8} \times M^2 - \ldots\ldots$, which is the amount of error due to taking Cos $U = 1$. For ordinary work we can drop the remainder of the series.

If our maximum error is to be $0.0001 = 10^{-4}$, we can find M by making $M^2 = \frac{10^{-4}}{4.234 \times 10^{-8}} = 2362$, and $M = \sqrt[2]{2362} = 48$ minutes.

This means that, for an accuracy of 0.0001, we can only break the Cosine to the nearest 48′; and if over 24′, we should take 0.9999 instead of 1 for the exact Cosine.

But, as we do not want to waste the 5° allowable for Sine, we can either take Cos $U = \sqrt{1 - \text{Sin}^2\ U} = (1 - \text{Sin}^2\ U)^{\frac{1}{2}} = (1 - \frac{1}{2}\ \text{Sin}^2\ U + \ldots\ldots)$; or we can use Cos $U = 1 - 2\ \text{Sin}^2\ (\frac{1}{2}U)$.

Since U was determined as small enough to cause its Sine to be proportional to the number of minutes contained, $\frac{1}{2}\ \text{Sin}^2\ U$ should $= 2\ \text{Sin}^2\ (\frac{1}{2}U)$, within the limits of required accuracy.

We are now prepared to apply these principles to actual work. In Fig. 3, I show a three-course traverse for which we desire the closing line DA. I believe that this traverse will be sufficient to explain all ordinary cases.

For the first course, N 30° 30′ E, 202.2 ft.: Sin (30° 30′) = Sin (30° + 30′) = Sin 30° × Cos 30′ + Cos 30° × Sin 30′.

Sin 30° = ½; and, since 30′ is within our allowable 48′ but more than 24′, Cos 30′ = 0.9999; making Sin 30° × Cos 30′ = 0.49995. Cos 30° = 0.86603; and 30′, being less than 2½°, its exact Sine is 0.0002909 × 30 = 0.00873; making Cos 30° × Sin 30′ = 0.00754. The final summary is Sin (30° 30′) = 0.49995 + 0.00754 = 0.50749.

We can check this by a direct method, as follows: Sin $U = U - \frac{1}{3 \times 2 \times 1}\ U^3 + \frac{1}{5 \times 4 \times 3 \times 2 \times 1}\ U^5 - \ldots\ldots = U - 1/6\ U^3 + 1/120\ U^5 - \ldots\ldots = U - 1/6\ U^3 + \frac{3}{10\ U}\ (1/6\ U^3)^2 - \ldots\ldots$

Using our former substitution of $U = 0.0002909\ M$, we find Sin $U = 0.0002909\ M - 4.1028 \times 10^{-12} \times M^3 + \frac{3}{0.0002909M}\ (4.1028 \times 10^{-12} \times M^3)^2 - \ldots\ldots = 0.0002909M - 4.1028 \times 10^{-12} \times M^3 + \frac{1031}{M}\ (4.1028 \times 10^{-12} \times M^3)^2 - \ldots\ldots$ That will be far enough to carry this series, except in special cases.

U = 30° 30′ = 1830′; therefore M = 1830. Applying this value in our formula, we obtain Sin (30° 30′) = 0.53235 − 0.02514 + 0.00035 = 0.50756.

Cos (30° 30′) = Cos (30° + 30′) = Cos 30° × Cos 30′ − Sin 30° × Sin 30′. Cos 30° = 0.86603; Cos 30′ = 0.9999; hence, Cos 30° × Cos 30′ = 0.86599. Sin 30° = ½; Sin 30′ = 0.00873; therefore, Sin 30° × Sin 30′ = 0.004365. Summarizing, we find Cos (30° 30′) = 0.86599 − 0.004365 = 0.861625.

By the direct method: Cos $U = 1 - \frac{1}{2 \times 1}\ U^2 + \frac{1}{4 \times 3 \times 2 \times 1}\ U^4 - \ldots\ldots = 1 - \frac{1}{2}U + \frac{1}{6}\ (\frac{1}{2}U^2)^2 - \ldots\ldots$ Replacing U by its equivalent M, Cos $U = 1 - 4.23114 \times 10^{-8} \times M^2 + \frac{1}{6}\ (4.23114 \times 10^{-8} \times M^2)^2 - \ldots\ldots$, which is far enough to take the series for ordinary work.

For M = 1830, Cos (30°30′) = 1 − 0.141697 + 0.003393 = 0.861696.

We can now obtain our latitudes and departures by taking: Lat = 202.2 × Cos (30°30′) = 202.2 × 0.86166 = 174.23 ft., North. Dep = 202.2 × Sin (30°30′) = 202.2 × 0.50752 = 102.62 ft., East.

For the second course, N 37°45′ W, 101.1 ft.: Sin (37°45′) = Sin (30° + 7°45′) = Sin 30° × Cos (7°45′) + Cos 30° × Sin (7°45′) = Sin 30° × Cos (7½° + 15′) + Cos 30° × Sin (7½° + 15′) = Sin 30° (Cos 7½° × Cos 15′ − Sin 7½° × Sin 15′) + Cos 30° (Sin 7½° × Cos 15′ + Cos 7½° × Sin 15′) = Sin 30° × Cos 7½° × Cos 15′ − Sin 30° × Sin 7½° × Sin 15′ + Cos 30° × Sin 7½° × Cos 15′ + Cos 30° × Cos 7½° × Sin 15′.

For the above formula, we have derived: Sin 30° = ½; Cos 7½° = 0.99144; and we can see, by our rules for accuracy, that Cos 15′ = 1; Sin 7½° = 0.13053; and, by our rules for accuracy, Sin 15′ = 15 × 0.0002909 = 0.00436; Cos 30° = 0.86603; from which Sin (37°45′) = ½ × 0.99144 − ½ × 0.13053 × 0.00436 + 0.86603 × 0.13053 + 0.86603 × 0.99144 × 0.00436 = 0.61223.

(Note. In multiplying by such numbers as 0.99144, it is usually better practice to call 0.99144 = 1 − 0.00856.)

By the direct method: 37°45′ = 2265 = M.

Applying this in our formula Sin $U = 0.0002909M - 4.1028 \times 10^{-12}\ M^2 + \frac{1031}{M}\ (4.1028 \times 10^{-12}\ M^3)^2$, we find Sin (37°45′) = 0.65889 − 0.04767 + 0.00104 = 0.61226.

Now, Cos (37°45′) = Cos (30° + 7°45′) = Cos 30° × Cos (7°45′) − Sin 30° × Sin (7°45′) = Cos 30° × Cos (7½° + 15′) − Sin 30° × Sin (7½° + 15′) = Cos 30° (Cos 7½° × Cos 15′ − Sin 7½° × Sin 15′) − Sin 30° (Sin 7½° × Cos 15′ + Cos 7½° × Sin 15′) = Cos 30° × Cos 7½° × Cos 15′ − Cos 30° × Sin 7½° × Sin 15′ − Sin 30° × Sin 7½° × Cos 15′ − Sin 30° × Cos 7½° × Sin 15′.

By placing in our derived values, we find: Cos (37°45′) = 0.86603 × 0.99144 − 0.86603 × 0.13053 × 0.00436 − ½ × 0.13053 − ½ × 0.99144 × 0.00436 = 0.79073.

By the direct method: Cos (2265′) = 1 − 4.23114 × $10^{-8} \times M^2 + \frac{1}{6}\ (4.23114 \times 10^{-8} \times M^2)^2$ = 1 − 0.21706 + 0.00785 = 0.79079.

We can now obtain our latitudes and departures by taking: Lat = 101.1 × Cos (37°45′) = 101.1 × 0.79076 = 79.95 ft., North. Dep = 101.1 × Sin (37°45′) = 101.1 × 0.61224 = 61.90 ft., West.

For the final course, N 71°02′ E, 125.0 ft.: Sin (71° 02′) = Sin (75° − 3°58′) = Sin 75° × Cos (3°58′) − Cos 75° × Sin (3°58′).

In this case, for a change of procedure, I will derive the separate Sines and Cosines before starting the final calculations. Sin 75° = Sin (45° + 30°) = Sin 45° × Cos 30° + Cos 45° × Sin 30° = $\frac{1}{2}\sqrt{2}$ (Sin 30° + Cos 30°). I express the functions in this form in order to show a method of calculation that at times may prove of great service.

Let us consider Sin U + Cos U: (Sin U + Cos U)² = Sin² U + Cos² U + 2 × Sin U × Cos U = 1 + Sin (2U). Therefore, Sin U + Cos U = $\sqrt{1 + \text{Sin}\ (2U)}$.

In the same way it can be shown that Sin U − Cos U, and Cos U − Sin U = $\sqrt{1 - \text{Sin}\ (2U)}$, depending upon whether U is greater or less than 45°.

From the above we see:

Sin 75° = $\frac{1}{2}\sqrt{2} \times \sqrt{1 + \text{Sin}\ 60} = \frac{1}{2}\sqrt{2(1 + 0.86603)} = \sqrt{\frac{1.86603}{2}} = 0.96593$.

Cos 75° = Cos (45° + 30°) = Cos 45° × Cos 30° − Sin 45° × Sin 30° = $\frac{1}{2}\sqrt{2}$(Cos 30° − Sin 30°) = $\sqrt{\frac{1}{2}}$

$\times \sqrt{1 - \text{Sin } 60°} = \sqrt{\frac{1 - 0.86603}{2}} = \sqrt{0.066985}$ $= 0.25880$.

As a check against the above calculations, we have already derived the Sine of 15° (the complement of 75°) to be 0.25882; and the Cosine to be 0.965925.

If this large angle was checked by the direct method, we should use one or more term in both the Sine and Cosine series, if very accurate work is desired.

Sin (3°58′) = Sin 3° × Cos 58′ + Cos 3° × Sin 58′.

The 58′ is so close to our allowable 48′ that we can take its Cosine as 0.9999.

The 3° is under 5° and over 2½°, so we will take its Sine as $0.0002909 \times 180 - 0.0001 = 0.05226$.

Sin 58′ = $0.0002909 \times 58 = 0.01687$.

Cos 3° can be taken as $1 - \frac{1}{2} \text{Sin}^2 3° = 1 - \frac{1}{2}(0.05226)^2 =$ 0.99863.

From which we find, Sin (3°58′) = 0.05226×0.9999 + $0.99863 \times 0.01687 = 0.06910$.

By the direct method:

3°58′ = 238′ = M.

Sin $U = 0.0002909M - 4.1028 \times 10^{-12} \times M^3 + \ldots\ldots$

In this it can be seen at a glance that only two terms are necessary, making:

Sin (3°58′) = $0.0002909 \times 238 - 4.1028 \times 10^{-12} \times$ $(238)^3 = 0.06923 - 0.00006 = 0.06917$.

Cos (3°58′) = Cos 3° × Cos 58′ − Sin 3° × Sin 58′ = $0.99863 \times 0.9999 - 0.05226 \times 0.01687 = 0.99765$.

By the direct method: Cos $U = 1 - 4.23114 \times 10^{-8} \times M^2 - \ldots\ldots$; in which it can be seen that the remainder of the series can be eliminated.

For M = 238, Cos (3°58′) = 1 − 0.00240 = 0.99760.

Introducing the derived values, we find:

Sin (71°02′) = $0.96593 \times 0.99763 - 0.25881 \times 0.6913$ $= 0.94575$.

Cos (71°02′) = Cos (75° − 3°58′) = Cos 75° × Cos (3°58′) + Sin 75° × Sin (3°58′) = $0.25881 \times$ $0.99763 + 0.96593 \times 0.06913 = 0.32507$.

This gives:

Lat = 125 × Cos (71°02′) = 125 × 0.32507 = 40.63 ft., North.

Dep = 125 × Sin (71°02′) = 125 × 0.94575 = 188.22 ft., East.

(Note. In multiplying by such a number as 125, multiply by 1000 and divide by 8.)

Summarizing the traverse, we have:

First course, 174.23 ft. North; 102.62 ft. East.
Second course, 79.95 ft. North; 61.90 ft. West.
Third course, 40.63 ft. North; 118.22 ft. East.

The total North is 294.81 ft.; the total East is 220.84 ft.; from which deduct the 61.90 ft. West, leaving a net East of 158.94 ft. To close, return South 294.81 ft., and West 158.94 ft. This gives a right triangle of which the base is 158.94 ft.; the altitude is 294.81 ft.; and the hypothenuse is the closing line; from which the closing distance, or hypotenuse is

$$\sqrt{(294.81)^2 + (158.94)^2} = 334.93 \text{ ft.}$$

The Sine of the closing bearing will be $\frac{158.94}{334.93} =$ 0.47455, which divide by 0.00029 for the approximate angle.

$\frac{0.47455}{0.00029} = 1636' = 27°16'$.

This shows that the desired angle is, $U = (30° - V)$.

Sin U = Sin 30° × Cos V − Cos 30° × Sin V

Cos U = Cos 30° × Cos V + Sin 30° × Sin V

Replacing by the known values, we find:

$0.47455 = \frac{1}{2} \text{Cos } V - \frac{1}{2}\sqrt{3} \times \text{Sin } V$

$\text{Cos } U = \frac{294.81}{334.93} = 0.88021 = \frac{1}{2}\sqrt{3} \times \text{Cos } V + \frac{1}{2}\text{Sin } V.$

Multiplying the first equation by $\sqrt{3}$, we have:

$\sqrt{3} \times 0.47455 = \frac{1}{2}\sqrt{3} \times \text{Cos } V - 3/2 \text{ Sin } V.$

Subtracting the last equation from the one above, we obtain: $0.88021 - \sqrt{3} \times 0.47455 = (\frac{1}{2} + 3/2)$ Sin $V =$ 2 Sin $V = 0.05826$.

From this Sin $V = 0.02913$; and $V = \frac{0.02913}{0.0002909} =$ $100' = 1°40'$.

$U = (30° - V) = 28°20'$.

Which shows that the desired closing line is S. 28°20′ W., 334.93 ft. As before stated, I am making these calculations where I have no means of checking by the use of tables, but I feel confident that this closing line will prove to be correct.

In this kind of work there are no fixed rules. I have attempted to explain general principles, and to cover the most typical cases. From a practical standpoint, I prefer to calculate the large angles by the breaking-up process, and the small ones by the direct method. In presenting this article I am especially desirous of helping young engineers who are in training for military service. If they thoroughly grasp the principles involved, they will be in a position to make all necessary calculations, even if their tabular data should be completely destroyed by shell-fire.

MAKERS OF POTTERY in the United States reported another record-breaking year in 1917, which was $56,162,522, an increase of $7,945,280, or more than 16% over the value in 1916, according to figures compiled under the direction of Jefferson Middleton, of the U. S. Geological Survey. Ohio led with products worth $21,353,706, followed by New Jersey with $12,535,843, West Virginia with $7,243,900, New York with $4,076,817, and Pennsylvania with $3,194,944. California contributed 1.09% of the total.

THE FINAL FIGURES for lime burned and sold in the United States in 1917 are 3,786,364 short tons, valued at $23,807,877, as determined by G. F. Loughlin, U. S. Geological Survey. This is a decrease of 7% in quantity, but an increase of 28.6% in value when compared with the figures for 1916.

ELECTRIC FURNACES are responsible for the manufacture of such important products as aluminum, armorplate, calcium carbide, carborundum, graphite, high-speed steels, and silicon.

BUTTE, MONTANA

Litigation Over the Cement Copper Flotation Process.

The taking of testimony in the litigation between B. H. Dosenbach, consulting engineer for the Butte & Superior Mining Co. and other Jackling interests, and Milton F. Webster of the Merrill Metallurgical Co. of San Francisco, was recently concluded here. The suit was over the question as to who was the inventor of the process now known as the 'cement copper flotation process'. Upon the determination of the real inventor will depend the issuance of the United States Patent for the process. The taking of testimony started at Butte on September 23. Mr. Dosenbach was represented by J. Bruce Kremer of Butte and M. Coit of Washington; while Mr. Webster was represented by Archibald Cox and Harry A. English of New York. The testimony is of a highly technical character and very lengthy. The record will be printed and forwarded to Washington, where briefs will be submitted and arguments made on January 11, 1919.

The process is as follows: Oxide or carbonate ore ground fine is placed in a leaching-apparatus where the copper minerals are dissolved by sulphuric acid. After dissolution, the pulp containing the copper sulphate is placed in a tube-mill or other suitable vessel containing scrap or sponge iron, when the copper is precipitated as cement copper. The recovery of the cement metal from the pulp is effected by flotation, either in a pneumatic or other flotation apparatus. Mr. Dosenbach has already erected a large plant for the Chino Copper Co. at Hurley, New Mexico, which is treating low-grade oxide ores satisfactorily.

One strange feature of the case is that both patentees assert that they made the discovery at approximately the same time. Mr. Dosenbach, at the time of his discovery in November 1914, was engaged in making experiments on the zinc-sulphide ore of the Butte & Superior Mining Co., and was using copper sulphate as one of the reagents in the operation. He discovered that metallic copper was precipitated from solution in the pulp upon the iron parts of the experimental machine, and that particles worn off were floated with the zinc sulphates. He immediately started experimenting upon copper-oxide ores, with the resulting process described in the patent. Mr. Webster claims that he made the discovery in December 1914, at Spokane, Washington, while engaged in testing the leaching and precipitation of carbonate ores, and found that copper could be precipitated in the pulp. He afterward thought of separating by gravity concentration and later by flotation. The outcome of this litigation will be awaited with interest, as the process is particularly adapted to the low-grade oxide and carbonate ores that cannot be treated profitably by any other method.

The second furnace of the ferro-manganese plant at Great Falls has been blown-in.

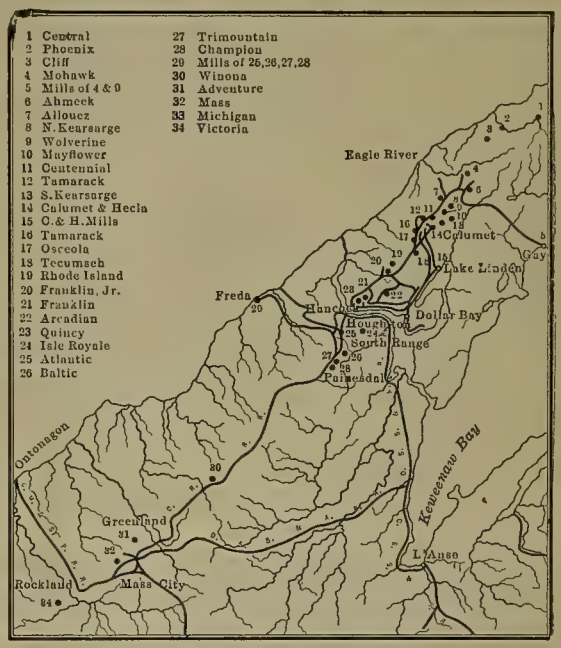
The new stack at the Washoe Reduction Works is nearing completion.

The Butte Copper & Zinc Mining Co., a subsidiary company of the Anaconda Copper Mining Co., has purchased the Ophir mine, and connection is to be made with the Emma zinc mine.

HOUGHTON, MICHIGAN

Labor.—Accidents.—Quincy to Build Re-grinding Plant.—Mohawk's Condition.—Women in Stamp-Mills.

Men are beginning to return to the Copper Country in small numbers; but larger numbers are expected if the reports of those coming back are correct. They explain that most of the men who have been attracted by higher wages paid to war workers now fear that they will have no jobs at all when the War is concluded, and they have learned that living conditions in the Copper Country have some ad-



THE COPPER COUNTRY, MICHIGAN

vantages not to be secured elsewhere. They remember also that, when reverses do come, these copper mines are always better able to weather financial and industrial crises than the average industry and that chances for a permanent position are better here than elsewhere. The thing that impresses the men who went away from this district to take war jobs is the difference in house rent. Most of them lived here in company houses, paying $5 or $6 per month; a similar house in the city cost from $30 to $40 per month. Besides that, the men were so far from their work that they spent a couple of hours daily on the street-cars, to say nothing of the cost of transportation.

There were 31 fatalities in Houghton county mines during the last fiscal year, according to the annual report of Alfred James, mine inspector. The total working force on hazardous occupations was 12,650, a smaller number than in a number of years. The percentage of fatal accidents is higher, notwithstanding the general use of numerous safety-first appliances. The explanation is that the mines have

lost many of their skilled men to the Army and have a large number of unskilled men trying to do their work. The percentage of fatalities for a decade is 0.0026. The high point was in 1908, when 17,974 men were employed, the percentage that year being 0.0035. In 1915 it was 0.0021, when 16,005 men were employed.

The Quincy company is building extensive additions to the stamp-mill at Mason. A complete re-grinding and flotation plant, similar to those in use at the Calumet & Hecla mill at Lake Linden, is to be put in. Extensive tests were made in a small mill on the sands. This plant has been contributing 25 tons of copper per month to the Quincy smelter, and has proved conclusively that the Pewabic lode formation offers a chance to save considerable copper by the extension of the additional concentrating plant. The new hoist at No. 2 shaft is enclosed in its new building, which is of architectural beauty as well as a practical engine-house. The engine is being set up rapidly.

Mohawk is harder hit than any other mine in the district by the labor shortage, and will be the last to recover because it is not close enough to the social centre to attract men. The ore output is averaging 1600 tons daily compared with 2500 tons under normal conditions. The ore is of higher grade lately, improving from 19 lb. to 26 lb. per ton. This is due to better underground conditions, as well as selection of ore.

Ore shipments to mills during October were as follows: Ahmeek, 94,000 tons; Allouez, 40,000 tons; Hancock, 75,000 tons; Isle Royale, 28,000 tons; Mass, 14,000 tons; La Salle, 15,000 tons; Osceola, 94,000 tons; and Superior, 7500 tons.

The new turbine at the Lake Linden plant is working satisfactorily. Calumet & Hecla's electric plant is now capable of generating 30,000 hp. This is utilized at the mine, at the mill, and is transmitted 12 miles for pumping water from the plant on the shores of Lake Superior.

The Lake Milling, Smelting & Refining Co., a Calumet & Hecla subsidiary that does custom milling for the Isle Royale, Hancock, and others, is now successfully employing women as head feeders. Women also have taken the place of men in the Calumet & Hecla leaching and flotation plants.

CRIPPLE CREEK, COLORADO

Gold Yield and Dividends.—Cresson Output.—Modoc Consolidated.

Gold production of the district during November totaled 88,700 tons, averaging $9.64 per ton. The gross total was $855,283. Compared with September there is an increase of 10,965 tons and $129,735.

Dividends paid in October totaled $242,000, as follows: Cresson, $122,000; Portland, $60,000; Golden Cycle, $45,000; and Vindicator, $15,000. The total paid this year amounts to $2,230,000.

During the year ended August 31, the Cresson Consolidated Gold Mining & Milling Co. produced a total of 108,336 oz. of gold, valued at $2,240,388. The gross production to date is $12,886,146. With the monthly payment of 10c., equal to $122,000, on November 10, dividends total $7,027,163.

The Modoc Consolidated Mines Co., in a supplemental report, announces that the final details of the merger arrangements between the Catherine and the Modoc have been completed, and that the Modoc is now operating the Last Dollar mine as well as the Modoc. The consolidation has added largely to the company's holdings, providing a deep working-shaft—1500 ft. deep—with powerful machinery capable of operating to a depth of 2000 ft. It is further advised that in exploring on the 1200-ft. level of the Last Dollar a large orebody has been found. Ore shipments are being made and the ore available assures funds to develop the mine.

PLATTEVILLE, WISCONSIN

Conditions in the Zinc Region During October.

During October the zinc region was practically demoralized by irregular prices for ore and spelter and by the influenza epidemic. The disease attacked all alike—from managers to common labor. The mining companies were keen in their efforts to help those stricken and their dependents. Lead-ore prices remained firm, with good demand. Some short-lived competition sent the price to $104 per ton. Production of pyrite from mines is still negligible, the zinc-ore separating-plants contributing most of this product. The price is unchanged at 25c. per unit of sulphur.

Shipments of mine ore to refiners in the field and smelters for 26 days totaled 13,105 tons of zinc, 625 tons of lead, and 1993 tons of pyrite. Deliveries from refineries totaled 6712 tons.

RENO, NEVADA

Aid to Gold Mining.—Recovering Precious Metals from Carson River.—Tungsten Near Sodaville.—National and Rochester.

Raymond T. Baker, Director of the Mint, and U. S. Senator Charles B. Henderson, of Nevada, attended a meeting at Reno on October 30 of the executive committee of the American Gold Conference, composed of Bulkeley Wells of Colorado; J. A. Fulton of Melones, California; and Whitman Symmes of Virginia City, Nevada; with Henry M. Rives, secretary of the Conference. It was announced that the committee was engaged in preparing statistics and information relating to the difficulties now confronting gold mining, which will be presented to Congress in the endeavor to secure relief for the gold producers. The committee will proceed to Washington shortly to present its case, and Senator Henderson promised to call a special meeting of the Senate committee on mines and mining, of which he is chairman, to meet the members of the Gold Conference and discuss legislative measures to aid gold mining. Mr. Baker declared that the Secretary of the Treasury, W. G. McAdoo, was keenly interested in the gold situation, that he had expressed a desire to extend all possible aid to the industry, and that he had formulated certain plans for stimulating gold production, which he would submit to the gold producers upon their arrival at Washington. Many phases of the gold mining situation were discussed and it was agreed that relief to the industry must be prompt to avert a critical condition in the gold-producing regions. Members of the committee were promised a cordial reception at Washington, with every facility at the command of the Treasury department, the Senate mines committee, and the Director of the Mint in obtaining a hearing of their case.

Material for a 7-ft. Armco iron flume is in transit to the point on the Carson river, between Empire and Dayton, where the Unevida Gold Mining Co., under the management of W. C. Ralston, Jr., is sluicing the tailing from the mills that treated by pan-amalgamation ore from the Comstock mines during the 'sixties and 'seventies. The flume will be used to divert the water and drain pools in the river-bed. A 4-in. centrifugal pump delivers the sand and gravel of the river-bed to a sump, whence they are raised by a 3-in. centrifugal to the head of a 65-ft. sluice. Concentrate from the sluice is rich in amalgam, fine gold, and virgin quicksilver. Tests on the fine, below the sluice, point to concentration on tables as the best method of recovering the metals in the black sand. Bedrock has been reached at one point by a 14-ft. shaft sunk in the Santiago bar, and the sand from the bottom of this shaft yields spoonfuls of virgin quicksilver in the pan. One yard of dirt from the Santiago tail-race was washed and the resulting concentrate was tested in a San Francisco laboratory. The value of the content was $123.66. This concentrate yielded 4 lb. quicksilver, $89.91

in bullion from the coarse sand, and the fine was sold for $1.35 per lb. One sample of concentrate from the sluice, tested at San Francisco, assayed $3565.57 gold, $275.50 silver, and $430.40 mercury, or a total value of $4271.47 per ton. High water in the river, resulting from recent heavy rains in the Sierras, has interfered with the work of the testing-plant, but the movable flume and sand-bag diversion dam will remove this difficulty, and the first pumping unit is expected to begin quantity production within 60 days.

Mining continues active in Mineral county. Twelve miles south-west of Sodaville, two tungsten mills are nearly completed, having a combined capacity of over 150 tons daily, while a third mill is proposed. High-grade scheelite has been shipped from ground here and a large quantity of milling-grade ore is said to have been opened for the new plants. Other tungsten deposits have been opened west of Sodaville and nearer the railroad.

Mines at National, in the northern part of Humboldt county, are producing rich gold ore, but in smaller volume than formerly; nearly all work at present is by lessees.

The corporate name of the Rochester Combined Mines Co. has been changed to the Silver State Mines Co., because of confusion resulting from similarity to other names in the district. Reports authorized by the management say that the new mill is treating 175 tons daily and is working satisfactorily.

TUCSON, ARIZONA

Preparations for a Geological Survey of Arizona.

The location of mineral districts not now being developed, also of oil districts, is predicted for the geological survey of Arizona which has just been undertaken by the State Bureau of Mines. This is known as one of the richest mineralized areas, but only small sections of it have been geologically examined. "The information will be of great value," said G. Montague Butler, director of the Bureau and dean of the School of Mines and Engineering of the State University, "inasmuch as when it is all at hand it will enable us to point out to prospectors favorable localities for certain things. It will enable us to speak with especial authority on the oil situation, which is engaging so large an amount of interest just now. We will be able to direct the search for coal deposits, artesian water, and a great variety of non-metallic substances, including clay and gypsum. Less is known of the geologic character of Arizona than of any other State. There are some counties of which we know nothing at all. The U. S. Geological Survey has made investigation in small districts but there does not exist anything like a comprehensive knowledge of the State's geology. Fully half the questions that reach the Arizona Bureau of Mines relate to the geology of the State, and it is anticipated that this work will enable the Bureau to answer a much larger proportion of these questions than has been possible in the past."

Olaf P. Jenkins has been appointed geologist by the board of regents of the University, under whose direction the Bureau is placed. His first work will be the preparation of a reconnaissance geological map. After completing this, the Bureau proposes to issue bulletins covering the geology and mineral resources of every county, and at this time more detailed geological investigations will be made and maps prepared of promising mineralized areas. The new geologist is a graduate of Leland Stanford University, of California. In 1911 he accompanied J. C. Branner, president of Leland Stanford, to Brazil, and assisted him in the collection of data which Mr. Branner later embodied in a geological map of that country. Mr. Jenkins served for some time as assistant geologist of Tennessee and in that capacity got out the last geological map of that State. Late in 1916 he was assistant professor of geology at Washington State College.

JOPLIN, MISSOURI

Ore-Producers and Zinc Smelters Arrange Prices for Ore.

The report of a committee of ore-producers that met with a committee of smelters at New York, and tentatively agreed upon marketing a specified tonnage of second-grade ore by January 1919, is exciting attention. The complete worsting of the ore-producers in the bargain seems apparent from a study of the schedules prepared. The committee reported to a meeting of producers on October 26 as follows:

Your committee, composed of the following: O. F. Brinton, Howard I. Young, F. N. Bendelari, John W. Hoffman, and W. B. Shackelford, met with the zinc committee at New York and the following resolution was prepared in conference with the zinc committee, to be presented to the smelters and operators for acceptance:

Whereas, a committee selected by the Joplin Ore Producers Association has met with the zinc producers committee appointed at the instance of Eugene Meyer, Jr., of the War Industries Board, to devise some plan for ensuring the continued operation of the Joplin mines, and to avoid an excessive 'spread' between the price of ore and the price of spelter, which has occurred and is likely to occur again, and meeting for such purposes having been held on October 15, 16, and 18, 1918; therefore, be it

THE ZINC REGION OF THE FOUR STATES

Resolved, That we recommend the following plan:

1. That the smelters will specify the quantity of ore that they will obligate themselves to take in approximately equal weekly quantities during the period ending January 1, 1919, and the ore-producers will furnish such tonnage, both subject to fires, strikes, accidents or other causes beyond the control of either party interrupting, curtailing, or suspending operations at smelters or mines, and neither party shall be liable for damages due to such interruptions, curtailment, or suspension.

2. That the ratio shown in the following table shall be the basis of the settlement for 60% zinc Joplin mill concentrates, subject to the variation of $1 for each unit above or below 60% zinc content, and subject to the customary lime and iron penalties of $1 for each unit of these ingredients in excess of 1%. Sludge material running not below 57½% zinc shall be penalized $2.50 per ton; sludge material

assaying less than 57½% and all flotation material shall be penalized $5 per ton. This schedule shall not apply to any ore below 50% zinc.

3. The market price of spelter governing settlements will be posted by the Joplin Ore Producers Association each Friday, and shall govern for one week. The quotation to be posted by the Joplin Ore Producers Association shall be the average of the daily quotation for prime Western spelter at St. Louis as given in the 'Engineering and Mining Journal' for the week ending the Wednesday previous to the Friday of the week in which the quotation is posted.

4. With such modifications as may be found necessary, this arrangement shall be continued from quarter year to quarter year as long as it is found feasible and satisfactory.

The scale of ratios between ore and metal was also worked out and is an equitable division of profit and loss as between the smelter and the miner based on the average cost of mining and smelting. The proposed scale is as follows:

Proposed Basis of Settlement for 60% Zinc Joplin Mill Concentrates at Various Spelter Markets

Spelter market, cents	Ratio	Price of 60% Joplin ore at mines
6.0	6.80 to 1	$40.800
6.1	6.79 to 1	41.419
6.2	6.78 to 1	42.036

This ratio goes on: for every tenth of a cent rise in the price of spelter, the ratio decreases one hundredth so that the scale goes on indefinitely. Even though spelter went to 15c. per lb, the producer would still be getting but $88.50 for his ore. This ore would cost him on the average above $60. His profit then would not be in excess of $28.50. If the smelter only obtained an 85% recovery he would get 1020 lb. of metal, which sold at 15c. would bring $153 gross. Allowing him $27.50 for a smelting charge, which would take care of a 100% increase in the cost of smelting, and deducting this and the price paid for the ore would leave a profit to the smelter of $37.50 per ton of ore smelted. This does not take into consideration any profit the smelter may obtain from the sulphur in the ore, which normally amounts to one ton of sulphuric acid for every ton of ore treated if his plant is equipped to manufacture acid. Thus one beholds a manufacturing business with small if any risk, making a 35% greater profit than the mining business which has many risks. The acid-maker still has his acid to add to his profit.

On the other hand, take a lower price for spelter for an example: At 8c. for spelter, the producer gets $52.80. This is certainly either cost or below the cost of production. The smelter would still have a margin of $28.80, or on the same basis as before, a profit of $1.80 per ton plus the acid. Any way the new arrangement is viewed it is a victory for the zinc smelters. On top of the ratio discrimination the very basis of spelter quotations is the journal aforesaid, whose spelter quotations have always been scouted by the mine operators of the Joplin district as strongly prejudicial in favor of the smelters as against the ore-producers.

Efforts are being made to have all second-grade ore-producers sign-up the agreement as soon as possible.

CHILE

Chuquicamata.—During the second quarter of 1918 the Chile Copper Co.'s operating profit was $2,075,550, less $629,802 for interest, etc. The net balance was $1,445,748, against $1,124,498 on the previous period. The cost per pound delivered at Atlantic ports was 13.87c., a decrease of 0.52c. The leaching-plant treated 950,885 tons of 1.58% ore, of which 79.84% was recovered. The output was 24,556,156 lb. Corresponding figures for the first quarter were 829,553 tons, 1.76%, 82.54%, and 24,876,498 pounds.

ANCHORAGE, ALASKA

General News of the Adjacent Territory.

A Federal Commission has made a survey of Alaskan resources with a special reference to the coal situation. It will report to the President and Congress on the mineral and agricultural possibilities of the Territory, presenting its needs and paving the way for development. The Commission is composed of E. O. McCormick, vice-president of the Southern Pacific railroad, chairman; George Watkins Evans of the U. S. Bureau of Mines; George C. McFadden, chief engineer of the Chicago Coal Co.; and L. A. O. Gabaney, a Chicago geologist. At a banquet tendered the Federal Commission by the local Chamber of Commerce the necessities of the adjacent mining districts were presented by local speakers, and suggestions were made that the Alaskan Engineering Commission be given appropriation and authority to construct spurs, feeders, and wagon-roads, or whatever mode of transportation may be necessary to develop the country adjacent and produce tonnage for the railroad. The matter will be brought to the attention of the Secretary of the Interior.

F. Le Roi Thurmond of Anchorage recently returned from a trip to the Ohio river in the Broad Pass district. He declared there were splendid prospects of copper, lead, silver, and gold that would justify exploitation; and that the progress of the Government railroad, which is surveyed to within 15 miles of the mineralized belt, would make their early investigation possible.

The Willow Creek district has had a successful season; the yield will approximate $100,000 more than the best previous year.——The Gold Bullion mine, operated by the Willow Creek Mines Co., has run continuously since May 29, and will continue to do so until forced to close down by cold weather.——The Miller-Bartholf people have erected a Straub stamp-mill and made a test run. They report $50 per ton on the plates.

William Martin has closed down the mill of the Alaska Free Gold Mining Co., which operated during the season on ore from the Gold Cord mine under lease to Mr. Martin. Platinum is reported to have been found in Willow Creek ores by a San Francisco assayer. Local assays have failed to verify the report.

Theodore Pilger, engineer in charge of the Mable mine, left for Butte on October 24. The mine is closed for the winter, after a season devoted to development, which totaled 540 ft. A compressor was put in. The company proposes to continue operations next season.

The Anchorage Gold Mines Co. has been incorporated to develop prospects on Archangel creek in the Willow Creek district. Byron Bartholf is president; Sidney Anderson, vice-president; E. N. Culbertson, treasurer; and A. G. Thompson, secretray. The capital is $100,000, shares $1 par. The company has a number of miners employed and contemplates working through the winter.

In the Cache Creek district the Cache Creek Dredging Co. employed 45 men, operating its boat from June 15 to October 15. The dredge has a capacity of 2000 cu. yd. per day. Coal dug from the company's mine nearby is used to generate steam.

Three hydraulic outfits operated in this district. The lack of transportation is a serious deterrent to successful operations, all freight having to be hauled 50 miles over a road passable only in the winter time.

Nome.—Recent telegraphic advice sent from Nome to Seattle states that influenza is raging there, over 300 cases being reported. Doctors and nurses have been sent there, as the situation is bad. Influenza is reported to be prevalent at other mining centres of Alaska.

In the next issue of the 'Press' will be an interesting letter on general conditions in Alaska.

THE MINING SUMMARY

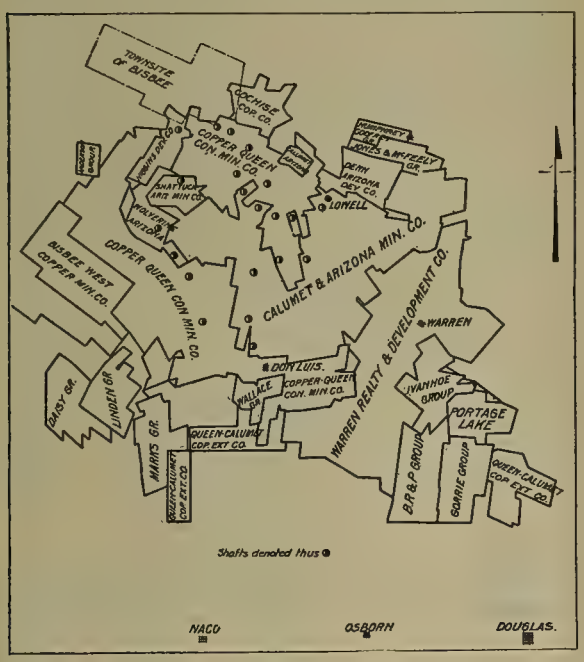
ARIZONA

Ajo.—New Cornelia pays its initial dividend, of 25c. per share, on November 25. This amounts to $300,000 on the 1,200,000 shares issued.

Douglas.—Copper production of the Phelps Dodge mines in October totaled 16,728,371 lb. Although 1,200,000 lb. more than September, it is 1,800,000 lb. below the average for the first 8 months of 1917.

Globe.—Work has been suspended at the asbestos property of the American Ores & Asbestos Co., situated in the Sierra Ancha mountains.

Hayden.—A new compressed-air pumping-plant, with 10



PROPERTY MAP OF BISBEE DISTRICT, ARIZONA

deep wells in the Gila bottom, is being installed to supply more water to the Ray Consolidated mill.

Jerome.—Directors of the United Verde Extension company report that there are no important developments at the mine. The blast-furnace at the smelter was started on July 18, and since July no ores have been shipped to outside smelters. Construction at the smelter is nearing completion, though subject to delays. The residences for the superintendent and master mechanic, and the store building have been completed at the smelter townsite. Further developments of the townsite will be limited to what is absolutely necessary. At the mine, no exploratory work of importance has been in progress. The Audrey shaft has reached a point 55 ft. below the 1600-ft. level, and the new hoist at this shaft is in service. The ore-pockets extending from the 1300 to the 1200-ft. level have been completeed. The skip-pockets that are below the 1400-ft. level have been completed. It is proposed to continue sinking the shaft until the 1700-ft. level is reached. The permanent electric power-lines have been installed in the shaft. Progress in the tunnel has been slow. Owing to an abnormal flow of water work was suspended at the Texas shaft. The water was under control and on September 15 work was resumed in the east heading from this shaft. On September 30 there was still a distance of 2600 ft. of tunnel to drive. Construction of dwellings at the townsite near the mine is under way. Good progress has been made at the Miners' hotel. Painters and plasterers have been engaged and the work is being finished at satisfactory speed. The supply of desirable labor is insufficient to satisfy the requirements of the mines. This condition has resulted from an exodus of skilled miners and mechanics to Government construction work at Nitro, West Virginia, and from British and American enlistments. The smelter in August treated 10,898 tons of ore, and in September, 12,688 tons. The estimated production for the year to September 30 is 42,236,387 lb. of copper. Cash on hand on September 30 was $1,990,882. The estimated copper shipped, returns on which have not been received, is 20,493,142 lb. The directors declared a quarterly dividend of 50c. per share and an extra dividend of 25c. per share payable on November 1.

The Jerome Superior has its two-compartment shaft down 620 ft. This shaft is about 2600 ft. from the United Verde Extension. At 500 ft. depth is a station, from which short drifts have been driven. Equipment includes a 75-hp. gasoline hoist, one 100-hp. and one 125-hp. oil-engine and compressor. Boilers of 250 hp. supply steam to the pumps. George Mitchell is in charge, with 30 men.

Kingman.—It is expected that the new leaching-plant of the Emerald Isle Copper Co. will soon be in operation.

The tunnel of the Walnut Creek Mining Co., 20 miles south-east of Kingman, is in 800 ft. So far it has opened promising ore, but the foot-wall has not been reached.

A contract has been let to drive a tunnel to cut the vein of the Missouri-Mohave mine to the north of the main shaft. Driving from the shaft on the 100-ft. level has opened some good ore.

Miami.—Owing to shortage of men, Inspiration Consolidated has been operating at times as low as 50% of capacity. At present, 15 of the 20 units in the mill are at work.

Copper production of the Miami company in October was 4,945,178 lb., practically the same as in September.

CALIFORNIA

Amador City.—The Fremont Consolidated Mining Co. has discontinued operations. The property is splendidly equipped and has always been kept in the best of repair. There are stopes that can be profitably mined under normal conditions. The cost of looking after the property in the meanwhile is considerable. In view of this, the present shareholders are unwilling to assume the risks. The underground equipment is being removed as rapidly as possible, and the lower pump was to be dismantled by the end of October. The mine will be allowed to gradually fill with

water. In the meantime the directors are so anxious to see the property redeemed from its impending fate that they have offered it for $60,000 cash. The surface equipment alone cost more than twice this sum. Arthur Goodall is manager.

Heroult.—A carload of electrodes from Niagara Falls for the Noble Electric Steel Co. was received here by express on October 26. The express bill was $1200. The electrodes were badly needed. The shipment was expedited by the War Industries Board, which has consented that other shipments in carload lots come through promptly by freight. The electrodes are 12 in. diameter and 5 ft. long. A new furnace under construction calls for electrodes 20 in. diameter.

Plymouth.—The Plymouth Consolidated reports as follows for September:

Ore treated, tons	10,700
Estimated yield (including concentrate)	£11,706
Working expenses	£7,081
Development expenditure	£1,283
Surplus	£3,342
Capital expenditure	£40

Redding.—The American Gold Dredging Co.'s new boat, across the river from Redding, started on October 23. R. K. Estep is superintendent. The boat, which was under construction for five months, cost $125,000. The company owns the Reid Ferry farm of 800 acres, most of which has been prospected. This makes the fifth dredge in operation in Shasta county.

COLORADO

Breckenridge.—The Tonopah Placers Co. made a net profit of $14,046 in the quarter ended August 31, 1918.

Garfield.—The Garfield Mining Co. is erecting a 50-ton mill on its property near here. It includes a Marcy mill, and concentration and flotation apparatus. Frank Lenox has been engaged as millman, and work is progressing rapidly. The property consists of 17 patented and 4 unpatented claims. Six thousand feet of development has been done, and large orebodies have been blocked out. From four to ten carloads of ore per month is being shipped to the Ohio Smelting Co. at Salida. The mill is expected to be in operation within 90 days.

Pitkin.—In this district the Pennsylvania Molybdenum Mines Co. is erecting a mill at its Bon Ton mine. Besides molybdenite, the ore carries copper, gold, and silver.

IDAHO

Hailey.—A deposit of graphite is said to have been found by Jesse D. Lee and his son Frank in Red Cloud gulch, 12 miles north-west of Hailey. Open-cuts show 15 ft. of clean steel graphite of a high degree of purity. It is said that an engineer in the service of the U. S. Geological Survey will examine the deposit shortly.

Wardner.—Another company proposes to explore the ground under the town of Wardner, namely, the North Bunker Hill Mining Co. It has filed 19 leases from owners of lots in the town granting the company the right to mine for 25 years under their property, paying 15% royalty to the owners. Another company, the Wardner Leasing Co., which has such leases from a large number of owners of Wardner lots, has done considerable exploration work.

MISSOURI

Joplin.—Production of the Tri-State region last week totaled 6284 tons of blende, 620 tons of calamine, and 1002 tons of lead. These averaged $55, $38, and $100 per ton, respectively. Missouri contributed $122,905 of the total of $491,725.

MONTANA

Butte.—Anaconda produced 22,345,000 lb. of copper during October. This is an increase of 1,600,000 lb. over September, but below the average for the year.

At a sheriff's sale on October 31 the Anaconda bid $57,000 for the Butte Central property for the Butte Copper & Zinc Co., which is controlled by Anaconda. The mine of the Butte Central is the Ophir. Its shaft is 2600 ft. south of the Emma mine, and a connection between the two will give the Emma an outlet through the Ophir.

Iron Mountain.—The Intermountain Copper Mining Co. has levied an assessment of 1c. per share. This is equal to $16,000.

NEVADA

Goldfield.—The Silver Pick company is to sink its shaft from 1275 to 1325 ft. As the 1260-ft. level is showing low-grade ore it was decided to sink deeper.

Tonopah.—Last week's production of the district totaled 8582 tons, valued at $145,984.

The Extension is sinking its Victor shaft 20 ft. below the 1760-ft. level to act as a sump for the collection of water. Prospecting on this level is to be started at an early date.

The North Star's last shipment to the West End mill averaged $31.08 per ton, and it is expected that the next one will equal this in value.

In driving a cross-cut 800 ft. south on its 600-ft. level, the Midway cut five separate veins from 18 to 60 in. wide. They contain from milling to shipping ore. The rock is trachyte.

During the third quarter of 1918 the Tonopah Mining Co. recovered silver and gold valued at $379,578. Net earnings totaled $143,766, less than half for the previous period. After paying $150,000 in dividends the surplus was $784,172, the same as a year ago. Loans to subsidiaries total $2,699,968.

Wonder.—The Nevada Wonder pays a dividend of 10%, equal to $150,000.

NEW JERSEY

Franklin Furnace.—The New Jersey Zinc Co. reports as follows for the third quarter of 1918, as compared with this period in previous years:

	1918	1917	1916
Net income	$5,330,781	$5,593,985	$8,304,511
Interest and reserves	115,000	115,000	115,000
Federal taxes	1,775,000	2,126,317	.....
Balance	3,440,781	3,352,668	8,189,511
Dividends	1,400,000	2,800,000	6,650,000
Surplus	2,040,781	552,668	1,539,511

OKLAHOMA

Picher.—The first ore-warehouse for the zinc districts was expected to be finished here by November 10.

Production of the various centres last week totaled 4520 tons of blende and 731 tons of lead, valued at $341,700.

UTAH

Bingham.—Utah Copper produced 19,000,000 lb. during October. In September the yield was 17,785,000 lb., and in August 19,920,000 pounds.

Park City.—This district produced 8063 tons of ore and concentrate during October.

Tintic.—The Iron Blossom paid 2½c. per share, equal to $25,000, on October 25. This makes $75,000 for 1918, and $3,185,000 to date.

WASHINGTON

Colville.—The Bruce Creek Mining Co., operating 30 miles north of this place, has opened on the surface a wide body of 50% zinc sulphide. A tunnel is in 415 ft. to develop the vein at depth. J. L. Stone is superintendent.

Loomis.—Lessees of the Copper Extension mine—Dempster brothers and others of New York—have let a contract to the Riblet Tramway Co. of Spokane to construct an

aerial tram two miles long, to connect the Copper World Extension and Copper World Mines with Palmer lake at the foot of Palmer mountain, on which they are situated. J. L. Drumheller and John Wentworth are the largest holders in the Copper World. The ore carries from 3 to 5% copper and an excess of iron and sulphur. Over 4000 tons has been sent to the smelter at Grand Forks, B. C. The tram will eliminate a steep haul of 8 miles.

Northport.—The Northport Smelting & Refining Co. has started foundations for a new drossing plant, to be erected at a cost of $50,000 to $75,000. Operation of a furnace has been suspended because of the shortage of ore from mines of the Coeur d'Alene region, due to a lack of men. The men rendered idle are engaged in the new work.

CANADA

British Columbia

Laurier.—The Tri-State Chrome Co. has a shipment of 10 cars of 40% ore ready to send to Niagara Falls. This company has a mill at Canyon City, Oregon, producing 8 tons of concentrate daily.

Ontario

Boston Creek.—The mill of the Miller-Independence will be in operation at an early date. A large quantity of ore is ready for treatment, some of which is a high-grade telluride. The mill is designed to treat the ore by a combination of amalgamation, concentration, and flotation methods.

Additional machinery for the mining plant of the Mondeau property, which was recently optioned to Detroit interests, has arrived. The Mondeau is the most extensively developed of a number of claims located on a heavily-mineralized dike, and the results of further operations are awaited with much interest by others in the neighborhood.

Cobalt.—Owing mainly to the bonus system based on the market price of silver, the labor situation here is satisfactory, workers being plentiful and the relations between employers and employees harmonious. The daily bonus above the regular wage is now $1.25, and the mines are operated efficiently.

A dispute has arisen over the location of the boundary-line between the Nipissing and the Violet property of La Rose Consolidated, an area of some 56 ft. in width including some of the workings of the Violet being claimed by both companies. Surveyors have been employed and a close examination of the ground made.

The winze being put down on the Ophir by the Mining Corporation has cut the Keewatin-diabase contact at a depth of 141 ft., or a total depth from the surface of 580 ft. Development will be carried on at the contact. The Mining Corporation is installing machinery on its recently acquired property at North Cobalt, where it will sink the shaft to the 300-ft. level.

At the Temiskaming a 9-in. vein carrying considerable silver has been cut at the 400-ft. level.

The Adanac is driving on a new vein at the 310-ft. level, where there is 9 in. of cobalt, niccolite, and ruby silver.

Elk Lake.—Production is going forward steadily at the Miller Lake-O'Brien, and it is expected that the output for the current year will be about $1,000,000 in value. Ore-reserves are unofficially estimated as containing 6,000,000 oz. An examination is being made of the Lucky Godfrey with a view to purchase by interests connected with the O'Brien Mining Company.

Gowganda.—The shaft on the Castle property, which is being developed under option by the Trethewey of Cobalt, is nearing the 300-ft. level where a vein formation has dipped into the shaft.

The Crown Reserve of Cobalt has relinquished the option held on the Walsh property, as it was considered that the result of operations did not justify so large a payment as $300,000.

The Clevenger Prophet is being developed by men in charge of Kirby Thomas. The shaft is down 300 ft., and lateral work is being done on the 200-ft. level with encouraging results.

Kirkland Lake.—The report of the Lake Shore for September marks a new high record with a production of $44,500 from the treatment of 1860 tons of ore, equal to $23.92 per ton. The mill worked 96.21% of the possible time.

At the Dominion-Kirkland a 5-ft. quartz vein has been opened. Test samples yield high assays.

The Wright-Hargreaves is arranging for the erection of its new 150-ton mill on the shore of Kirkland lake, north of No. 3 shaft. Considerable difficulty is being experienced in getting labor for the construction of the plant. The underground workings have been carried to a depth of 400 feet.

Porcupine.—The expectation that Government assistance will shortly be given to the gold-mining industry is encouraged by the receipt of a communication from the British government by Thomas W. Gibson, provincial deputy Minister of Mines, asking for information as to the cost of production at the gold mines of Ontario. The matter is being taken up with the officials of the companies, and some measure of relief from the Imperial government is anticipated. Meanwhile, though many of the smaller mines have been closed, production is being kept fairly up to the mark by those remaining in operation.

The annual report of the McIntyre for the year ended June 30, 1918, is of a highly satisfactory character, showing a production of $1,793,197 from the treatment of 178,327 tons of ore. The average value was $10.05 per ton, and the operating cost $5.14 per ton. The total profits were $811,571, of which $680,361 was transferred to surplus account. The estimated value of reserves was $4,490,432. At the annual meeting the shareholders approved the by-law authorizing the directors to acquire the Plenaurum property, on which the company now holds an option.

The second shaft of the Davidson, which is nearing the orebody indicated by diamond-drilling, has cut a rich stringer below the 450-ft. level, believed to be a lead from the main orebody. Assays taken from the drill-cores showed $24 at the 550-ft. level, and $27 at the 650-ft. level.

MEXICO

Chihuahua

Chihuahua.—An American Consular Report of October 9 states that due to the present high price of manganese ore ($18 U. S. currency per ton f.o.b. Chihuahua) much interest is being taken in the location of claims and in exporting manganese to the United States. More than 50 claims have been registered at the local mining office of the Federal government during the last three months. These claims are in the immediate vicinity of Chihuahua, along the railroad south-east of Chihuahua as far as Ortiz, and west of Chihuahua along the North West Railroad of Mexico. The first shipments were made in September 1917, and at present 350 tons is being exported monthly to the United States. The manganese shipped averages 40%, some as high as 48% Mn. In this city there are several brokers engaged in purchasing manganese ores and shipping them to the United States. A large number of men, having burros, are now earning a living by hauling manganese from the mines to the nearest railroad point.

Mexico

Mexico City.—The Mexican government has rescinded the decree requiring mining companies to return gold to the extent of 25% of the value of silver ore exported from Mexico. Officials say that the oil question will be satisfactorily settled within the next few weeks.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

James W. Neill is at Bingham.

F. W. Bradley has returned from Juneau.

J. L. M. Creede of Tucson is at the Bellevue hotel.

Glenn A. Wallerstedt has joined the Marine Corps.

R. B. Robertson and **John D. Barnes** of Butte are in San Francisco.

W. E. Thorne is on his way to Nigeria, by way of New York and London.

Jackson A. Pearce has left Berkeley on a visit to the Joplin district, Missouri.

J. A. Willey has been made Captain of Engineers, and is at Jamestown, North Dakota.

H. A. Chapman, recently at Telluride, as engineer to the Liberty Bell Mining Co., is here.

Ernest Gayford, of the General Engineering Co., Salt Lake City, has gone to New York.

Cecil Fitch, superintendent of the Chief Consolidated at Eureka, Utah, is recovering from an attack of influenza.

M. Robert Guggenheim, holding the rank of Major, has returned to New York after a year spent in France.

P. G. Beckett has been granted leave of absence by the Phelps Dodge Corporation in order to enter the Army.

Willet G. Miller has been appointed a member of the Committee of the Gold Producers of the Empire in London.

J. Power Hutchins, who has been visiting the copper districts of Arizona, is expected in San Francisco this week.

A. R. Whitman, formerly at Cobalt, has become instructor in topography to the S. A. T. C. at Columbia University.

James F. Kemp has gone from Bingham to Oregon, whence he will proceed to Butte before returning to New York.

G. D. Kislingbury, son of George Kislingbury of Los Angeles, is manager of a tungsten mine at Hereford, Arizona.

W. Shellshear has returned from the Burma Mines, in the Northern Shan States, to the Broken Hill Proprietary, in Australia.

C. A. Botsford has left Crested Butte, Colorado, to become general manager for the Mogollon Mines Co., at Mogollon, New Mexico.

Pierre de P. Ricketts announces that Ricketts & Company have moved their office from 80 Maiden Lane to 280 Madison avenue, New York.

Rush T. Sill of the firm of Sill & Sill, has received a commission as Captain of Engineers and is reporting to Fort Douglas for training.

J. B. Tyrrell has recently visited the Bourkes and Miller-Independence mines and gold prospects in the Matachewan district, in northern Ontario.

Murray Coleman has resigned his position as assistant superintendent for the Atolia Mining Co. to become manager for the C. Fabre Brandt mines in Japan; he sailed for the Orient on November 8.

Bennett R. Bates has resigned as general superintendent for the Cubo Mining & Milling Co. at Guanajuato, Mexico, to accept a commission as First Lieutenant in the 403rd Engineers. **R. R. Leslie** succeeds him.

B. L. Cunningham has resigned as assistant geologist to the Southern Pacific Co., and has accepted the position of consulting geologist for the Doheny Pacific Petroleum Co., with offices at 1011 Security Bdg., Los Angeles.

W. C. Browne, superintendent of the Prince Consolidated mine, has resigned, to enlist in the Officers Training Corps. He has been with the company for eleven years and superintendent for two years. **J. H. Hedges** succeeds him.

Mark Walker has accepted the chair of Professor of Chemistry in the University of Redlands, to which he will give a portion of his time. He will continue his former business of consulting chemical and metallurgical engineer, assayer, and chemist.

Edward E. Bugbee, Professor in the Mining Department of the Massachusetts Institute of Technology, has been granted a leave of absence to accept the position of Assistant Director of Education for the S. A. T. C. in five Southern States, with headquarters at Raleigh, North Carolina.

E. M. Norris, for the past six years foreman of the Tramway mine, has been appointed assistant general superintendent of mines for the Anaconda Copper Mining Co. under **John Gillie**. This was the position held recently by **C. L. Berrien**, now a Major in the Aviation Department in France.

A. G. Langley, Provincial Resident Mining Engineer, with headquarters at Revelstoke, B. C., has been appointed to represent the Provincial Government at the pending inquiry into the rates charged by the Consolidated Mining & Smelting Co. for the treatment of custom ores at the Trail smelter.

Obituary

Thomas Stacey, formerly manager of the Dromedary Hump Con. Mines Co., at Fairview, Nevada, died recently. **Edward W. Stratton** succeeds him.

Howard S. Lee, manager of the Leadville Unit of the U. S. S. R. & E. Co., until it was closed in August, died from an attack of influenza on October 22. He contracted the disease at Silverton and died at Denver.

C. A. Waring, geologist on the staff of the State Mining Bureau, died at his home in San Francisco on November 4 from pneumonia following an attack of Spanish influenza. He graduated from Stanford University in 1911. His death is deeply regretted by his many friends among those engaged in mining in California.

Myron H. Peck, Captain in the Second Engineers, A. E. F., was killed in action in France on October 9. He received his technical training at the University of California, graduating in 1897. For several years he was professor of civil engineering at the Imperial University at Pekin. He returned to the United States in 1910 and engaged in various engineering work, including jetty construction at the mouth of the Columbia river and the improvement of the channel at Mare Island. For several years he maintained offices in San Francisco. He was commissioned Second Lieutenant of engineers in the National Guard of California in 1916 and saw service on the Mexican border. Later he entered the Engineer Officers Reserve Corps and was assigned to Camp Lee, in Virginia. From there he sailed for France early in January of this year. He is survived by a wife and two children.

The U. S. Civil Service Commission announces that examinations will be held in San Francisco at an early date for petroleum technologist, at a salary from $2500 to $3000, also for a vacancy in the U. S. Bureau of Mines at Washington.

THE METAL MARKET

METAL PRICES

San Francisco, November 12

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound	13.00
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound	11.00
Zinc-dust, cents per pound	16.00

ORE PRICES

November 12

Chrome, no definite quotations available.

Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.25
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$26

EASTERN METAL MARKET

(By wire from New York)

November 12.—Copper and lead are unchanged. Spelter is quiet and easy.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 49½ pence.

	New York,	London
Nov. 6	101.12	49.50
" 7	101.12	49.50
" 8	101.12	49.50
" 9	101.12	49.50
" 10 Sunday		
" 11 Holiday		
" 12	101.12	49.50

Average week ending	
Oct. 1	101.12
" 8	101.12
" 15	101.12
" 22	101.12
" 29	101.12
Nov. 4	101.12
" 12	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	63.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	65 51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	6 .86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Samuel Montagu & Co. of London, writing on October 24, stated that for a long time past, the tendency of the silver market has been described as good. A new factor has now to be taken into consideration, namely, the present cessation of Indian remittances, owing to the unsatisfactory character of the monsoon; but it is not likely to have an important effect upon the general need for silver. There is always the possibility of a small reduction in the maximum London price in order to correspond with a possible lessened charge for insurance on supplies sent to this country from America.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date	
Nov. 6	26.00
" 7	26.00
" 8	26.00
" 9	26.00
" 10 Sunday	
" 11 Holiday	
" 12	26.00

Average week ending	
Oct. 1	26.00
" 8	26.00
" 15	26.00
" 22	26.00
" 29	26.00
Nov. 4	26.00
" 12	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
Nov. 6	9.00
" 7	8.95
" 8	8.90
" 9	8.85
" 10 Sunday	
" 11 Holiday	
" 12	8.85

Average week ending	
Oct. 1	9.55
" 8	9.31
" 15	9.02
" 22	9.08
" 29	9.04
Nov. 4	8.96
" 12	8.91

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date	
Nov. 6	8.05
" 7	8.05
" 8	8.05
" 9	8.05
" 10 Sunday	
" 11 Holiday	
" 12	8.05

Average week ending	
Oct. 1	8.05
" 8	8.05
" 15	8.05
" 22	8.05
" 29	8.05
Nov. 4	8.05
" 12	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefore $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date	
Oct. 15	120.00
" 22	120.00

Oct. 29	120.00
Nov. 4	120.00
" 12	120 00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120 00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	78.82
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91 00	Dec.	42.55	85.00	....

ORES (New York)

Antimony: No reports of any business.

Ferro-silicon: It is understood that those producers of 10 to 12% ferro-silicon in electric furnaces, who have been obtaining from $75 to $85 per ton, will have to submit to fixed prices, silimar to the price for the blast-furnace products of like composition.

Manganese Alloys: Steps have already been taken to cut down the output of ferro-manganese and spiegeleisen by putting blast-furnaces on pig-iron. Already several furnaces have either gone on to pig-iron or have been ordered to do so. The movement is the result of the advice and request of the War Industries Board. It was not unexpected, as the output of ferro-manganese was about 26,000 tons in September and of spiegeleisen about 40,000 tons, according to the blast-furnace reports of 'The Iron Age.'

Molybdenum: Demand is light, with the market dull and nominal at previous quotations.

Tungsten: Peace developments and the election holiday put a curb on any desire to do any more business than necessary. As a result, the market has been quiet, only a few lots of high-grade ore having been sold. Prices are unchanged and nominal at $20 to $26 per unit, depending on the purity of the ore. The last quotation on ferro-tungsten was $2.55 per lb. of contained tungsten, but no test of the market is reported. It is believed the alloy can be bought under this level.

Eastern Metal Market

New York, November 6.

Where the markets are under no control there is an absence of demand, and in others conditions remain unchanged and featureless.

With the price of copper fixed to January 1 it is only a matter of supply to meet the large war demand.

The tin market is rapidly adjusting itself to Government and International control.

The lead situation is entirely unchanged and under rigid control.

The zinc market is lifeless, demand being very light; prices have hardly changed.

Antimony has undergone a marked decline.

The principal question in the steel industry is how fast war demand for iron and steel will now fall off. The moves made this week in the reduction of munitions and ordnance orders are of considerable significance with peace more probable than ever. A revision of the plans for the big Neville Island gun plant is said to be under way, while it seems quite certain that work will not go forward on the 12-in. howitzer plant to have been erected by the Midvale works at Philadelphia. Considerable shell-steel is still on the Allies' books, and the first cancellation will probably come from them. The October pig-iron output was cut down by influenza, and the expected record could not be made. The output was 3,486,941 tons or 112,482 tons per day, against 3,418,270 tons for 30 days in September, or 113,942 tons per day, according to 'The Iron Age'. The October record was only once before exceeded previous to September, and that was in October 1916, with 113,189 tons per day.

COPPER

It has been pointed out that the world's production of copper has expanded 40% in the last five years. This has been done not by an increased number or a more efficient set of men, but by the use of men who have been engaged in development and construction work. This fact of larger output will have an important influence in determining the fate of the copper market when normal times return. It is probable that the present price of 26c. per lb. will rule until the War ends, if it does not end before January 1, the date set for the expiration of this price. Whether Government control will obtain after peace comes is another factor. Some think that when an open market again rules prices will not go above 26c., no matter what the demand may be, citing the fact that before the War the highest price had been 12 to 15c. per lb. Output of refined copper is lagging, due largely to influenza. When operating at capacity the refineries can turn out 250,000,000 lb. per month; lately their production has been from 170,000,000 to 200,000,000 lb. per month.

TIN

Official announcement has appeared in the past week from the Tin Section of the War Industries Board over the signature of George Armsby, chief of the section, that the tin trade is under the control of the International Tin Executive, sitting in London, and that so far as the United States is concerned all licenses for importation will be granted only to the U. S. Steel Products Co., which will deliver the tin through the American Iron and Steel Institute at cost to consumers. Details of the plan are lengthy, and have appeared in the public press. It is plain that the old importers, who have conducted this vast and important business for so many years, are out of business for the period of the War. If this control will obtain after the War is difficult to say. It is also officially stated that licenses will be issued to such importers for the filling of all contracts entered into prior to October 1, so that this part of the program will go on as under the old régime. The Tin Importers' Association, Inc., recently formed in New York, has just issued a set of resolutions which it has sent to the War Industries Board and to the trade. After reviewing the steps that have led up to the present system of control, and after stating that the decision to regulate the trade was made without consulting the tin trade as a whole, as had been done in other similar situations, it terms the present plan as a virtual monopoly by the largest consumers of tin in the country and protests against the continuance of such a plan. It asks to be heard by the Board, and offers to suggest other methods of controlling the trade that it believes to be more just to all concerned. There has been the usual small trade in the last week in tin en route or to arrive by those desiring to get rid of the metal before a price is fixed, concerning which no official word has yet come out. Such sales have been made at about 75c., New York, which is the nominal quotation for spot metal. These transactions have not aggregated over 500 tons, it is believed. Tin arrivals in October were 3575 tons through Pacific ports and 685 tons through Atlantic ports, a total of 4260 tons. There was also 190 tons in stocks and landing on October 31. The London market is unchanged at £344 per ton for spot Straits.

LEAD

There is no change to report in the situation, conditions as to distribution and prices being under strict control, with the Lead Producers' Committee giving entire satisfaction. It is understood that the output for the remainder of the year has been oversold, and that there is little prospect of any relief as to extra supplies. Prices remain fixed by agreement at 7.75c., St. Louis, or 8.05c., New York.

ZINC

The market is absolutely lifeless and is indirectly marking time, awaiting international developments. Demand is light from both consumers and dealers, but quotations are unchanged today from those of a week ago at nominally 8.60c., St. Louis, or 8.95c., New York, for prime Western for early delivery. For prompt the quotation is 8.65c., St. Louis, or 9c., New York. Late last week this price stiffened a little to 9.10c., New York; or 8.75c., St. Louis, on a fair demand, strengthening also the early delivery market slightly to 8.65c., St. Louis, or 9c., New York. For first quarter the quotation ranges from 8 to 8.12½c., St. Louis, or 8.35 to 8.47½c., New York, with most dealers asking the higher price. December delivery is quoted nominal at 8.37½c., St. Louis, or 8.72½c., New York. Both output and stocks have decreased in the week ended October 26, according to the Government weekly report, the former about 800 tons and the latter about 2400 tons, making a strong statistical position.

ANTIMONY

Demoralization seems to have hit this market, which, on light demand and eagerness to sell, has fallen to 10.50c., New York, duty paid, nominal, for wholesale lots. Prospects of peace are evidently not regarded as a bullish factor.

ALUMINUM

The market is under Government control at 33c. per lb. for 50-ton lots, at 33.10c. per lb. for 15 to 50-ton lots, and at 33.20c. per lb. for 1 to 15-ton lots. These quotations apply to No. 1 virgin metal and to scrap only.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

CONVEYORS REPLACE COMMON LABOR

Nowhere in the industrial fabric has the disturbance brought on by war conditions been more keenly felt than in the unskilled labor market—among the shovelers, lifters, and movers of goods and materials.

This situation aroused great interest in light, portable material-handling machines. It became an established principle with many companies not only to replace labor by machinery whenever the machine could do the work cheaper,

LOADING COKE-CARS BY MEANS OF A PORTABLE BELT-CONVEYOR.

but to prefer the machine if the costs were the same or even slightly higher.

Light, strong, well-designed portable conveyors, economical of power, easily moved about and set up, made their appearance. They are adapted to handling coal, sand, gravel, ashes, salt, chemicals, package goods, brick and stone. They

USING A CONVEYOR TO LOAD A RAILROAD-CAR.

were designed and built in standardized sections that could be assembled in units of any length to meet any requirements. This made it practical to carry at factory for prompt shipments a large stock—and held down the investment tied up in such a stock to reasonable proportions. These conveyors in hundreds of businesses have proved their ability to reduce handling costs from 50 to 90%. Single units have replaced from 3 to 20 men. They were so badly needed that they have paid for themselves, in many cases, in less than a month.

Such portable belt-conveyors elevate as well as move material and so have made it possible to use more fully the storage space available. Without additional cost, material can be piled to the top of a warehouse or a coal-shed—and on the open ground, higher and more compact piling of material is possible. Additional construction of storage buildings can in this way often be avoided. In the service of the Western United Gas & Electric Co. at its plant in Joliet, Illinois, two B-G portable belt-conveyors made by the Barber-Greene Co. of Aurora, Illinois, are operated in series in loading coke into railway cars. These cars are loaded in from two to four hours, according to size and type, with less than half the labor that was previously required to load them in from 7 to 10 hours. The saving in cost is about 50%. This is typical of results secured by use of these conveyors in many places.

Several types of conveyors have been worked out to meet different requirements by the Barber-Greene Co. For elevating at angles under 25° a plain belt is employed. For angles of 30 to 35° a belt equipped with steel flights is provided to prevent the material slipping down the grade. For chemicals that will corrode, metal conveyors of similar design are provided with wooden frames. The conveyors are made portable by mounting them on a wheeled truck or suspending them from a trolley attached to an overhead steel cable.

A wide variety of applications have been worked out since these conveyors went into use—many of them unforeseen until they were discovered in practical use. They unload cars into piles, into storage sheds, into wagons or motor-trucks. They load cars from trucks or wagons, storage piles, or sheds. Where the carry is longer, two or more conveyors can be worked in combination—sometimes with a chute between them. A careful study has been made of piling systems and methods developed by which the largest tonnage can be stored on a given amount of surface. A few methods of applying the conveyor are illustrated in the accompanying illustrations.

MAKING BLACK BLASTING POWDER

By W. J. Cahalan

Black blasting powders are divided into two main classes —'A' blasting and 'B' blasting. The methods of manufacturing both are practically identical, the difference being in the ingredients used.

Composition of 'A' blasting is about 75% saltpetre or nitrate of potash, 15% charcoal, and 10% sulphur. It is somewhat stronger and quicker in action than 'B' and is less liable to deteriorate with age or exposure to the elements on account of the fact that saltpetre is practically non-hygroscopic, while nitrate of soda which is used in the manufacture of 'B' is more hygroscopic. The 'A' grade is also more expensive than 'B' grade, due to the high cost of saltpetre as compared to the cost of nitrate of soda.

Nearly all the saltpetre used in this country for some years previous to the beginning of the world war was made from nitrate of soda, imported from Chile, and muriate of potash, imported from Germany; practically the entire commercial supply of potash for the whole world was obtained from the mines at Stassfurt, in the Prussian province of Saxony. Previous to that it was imported from India. Since the beginning of the present war considerable amounts have been obtained from the same source, but as the supply is

controlled by the British government, the East India saltpetre imported since the beginning of the War had to be used in the manufacture of powder for military use exclusively. The Du Pont company has succeeded in producing a limited quantity of saltpetre independent of the above sources by refining Chilean nitrate of soda containing a high percentage of potash.

'B' blasting powder is composed of about 75% nitrate of soda, 15% charcoal, and 10% of sulphur. Nearly all the black blasting that is used at the present time consists of 'B'.

In the manufacture of black powder the saltpetre or nitrate of soda is first reduced to fine particles in what is called a 'beater', consisting of an iron cylinder containing beaters or paddles which revolve at a high rate of speed, beating the material between the paddles and the outer edge of the cylinder. The charcoal and brimstone are weighed and mixed in proper proportions and charged into large iron cylinders containing iron balls, the cylinders are then set in motion, and the action of the iron balls pounding against the ingredients pulverize them into very fine particles. This operation also serves to thoroughly mix these two ingredients and make what is termed 'pulverized dust'.

The next step is to weigh the prepared ingredients in proper proportions, in bags, and transport same to the incorporating mills, commonly called 'wheel mills'. This is where the ingredients first become powder or explosive.

A wheel mill is a mortar and pestle on a large scale. The mortar consists of an iron bed plate about 10 ft. diam. with flaring wooden staves, which form a tub or pan, and the pestle consists of two iron wheels about 6 ft. in diam. and 20 in. face, weighing around 10 tons, which revolve on the ingredients after they are placed in the pan. Wheels are preceded by plows which throw ingredients both from the outer edge and centre of pan toward the middle of the faces of the wheels, and the ingredients are thus thoroughly incorporated and make what is known as 'wheel cake'.

The wheel cake is taken to a press mill, of hydraulic type, assembled in a horizontal position. The box in which the powder is pressed is constructed of hard wood and is about 2 ft. square and 10 ft. long. Aluminum plates are placed in the press box in a vertical position, and are held by slats of wood fastened to a header, or 'finger-boards'. The powder is shoveled into the box, falling between the aluminum plates, and when the box is filled, the finger-boards are removed, hydraulic pressure applied, and the powder is pressed into cakes about 1 in. thick and 2 ft. square.

The press cakes are transported to the corning mill, where they are cut up into grains of the desired size by being passed between pairs of zinc rolls, the size of the grains being governed by the distance which the rolls are set apart. Screens are installed beneath the rolls for the separation of the useful grains from the dust.

The grains are taken from the corning mill to the glazing or finishing mill, where they are dried and polished in large revolving barrels. A small amount of graphite is added for the polishing of the grains, the purpose of which is to make them more resistant to moisture.

After the powder is dried and polished it is taken to the packing-house, where it is separated in an oscillating separator into the different sized grains desired. The separator is fitted with screens of the proper perforation.

The combustion of black powder is controlled by the sizes of the grains—the larger the grains the slower the powder burns and the smaller the grains the faster it will burn. To assist in the regular combustion of each granulation a great deal of attention is given toward insuring an even density of the powder; this is controlled in the pressing process.

Black powder has been made and used for centuries, and up until a few years ago was the only kind of powder made, and while it has been replaced for many uses by high explosives, it is still in great demand. More of it was used in the United States in 1917 than in any previous year, as nothing has been found to equal it for the economical mining of coal, blasting of slate, blasting of stone, where it is desirable to get out large unbroken pieces, or in earth blasting, where it is desired to move a mass of earth bodily, and where there can be no danger of igniting dust, gas, or firedamp.

FASTENING WIRE-CABLE ENDS TO SOCKETS

Many riggers who have experienced difficulty in making a satisfactory joint when placing a forged socket on the end of a wire cable will doubtless be interested in a new method developed by John T. Willison of Ambridge, Pennsylvania. Mr. Willison, who was testing 19-strand cables for tensile strength, was particularly interested in making a joint which would be stronger than the cable itself. After trying several methods unsuccessfully, the joint failing in each case before the cable was loaded to capacity, he finally conceived the idea of securing the cable in the socket with Smooth-On iron cement in the way illustrated by the sketches. The cable end was first passed into the socket as

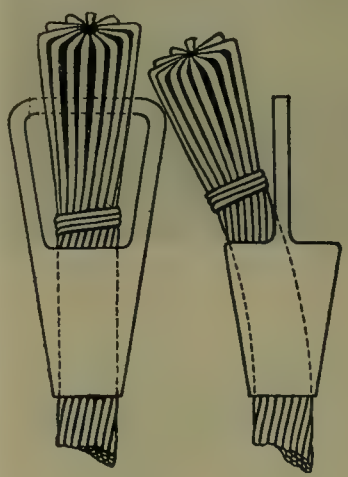


FIG. 1.

FIG. 2.

illustrated in Fig. 1. One of the outside wires was untwisted and wrapped tightly around the others. Above this wrap the remaining wires were untwisted and belled out as shown and the ends turned down. Smooth-On iron cement No. 1 was mixed with water to a smooth putty-like consistence and the socket packed closely with it. The cable was then pulled firmly into place and the cement allowed to metallize. In metallizing, the Smooth-On iron cement expanded sufficiently to completely fill the spaces between the wires and between the cable and the socket shell and to wedge the joint securely. A firm union resulted which, on test, proved to be stronger than the cable itself.

Garfield Myers has been granted a legal change of name by the Superior Court, and will hereafter be known to his business friends and associates as C. A. Garfield, and the firm name of Garfield Myers & Co. will hereafter be known as **Garfield & Company.** There is no change in the personnel of the organization, or in the lines of construction machinery and equipment they handle.

The Chicago Pneumatic Tool Co. announces the election of H. D. Megary to the office of secretary, vice W. B. Seelig, resigned.

Mining and Scientific Press

Edited by T. A. RICKARD

Volume 117
Number 21

SAN FRANCISCO, NOVEMBER 23, 1918

15 Cents per Copy
$4 per Year

AN INDEPENDENT WEEKLY PAPER OWNED, EDITED, AND MANAGED BY ENGINEERS

WE FURNISHED THE

UNITED STATES GOVERNMENT

2,009,878 FEET REMCO PIPE

Camp	Feet
Camp Sevier, S. C	4,008
Camp Dodge, Ia	125,895
Camp Humphreys, Va	8,003
March Field, Cal	10,056
Mather Field, Cal	17,930
Army Camp, Texas	6,302
Mare Island Navy Yard, Cal	8,006
Quartermasters Terminals, S C	54,826
Camp Perry, Ohio	15,917
Camp Abraham Eustis, Va	76,708
Camp Harry J. Jones, Ariz	9,308
Marine Trainnig Camp, Va	50,955
Camp Travis, Texas	11,763
Explosives Plant, W. Va	16,500
Camp Lee, Va	24,957
Norfolk Q M. Terminals, Va.	10,139
Camp Shelby, Miss	31 299
Camp Greene, N C	13 109
Camp Hancock, Ga	46,014
Camp McArthur, Texas	24,407
Camp Logan, Texas	29,307
Camp Wadsworth, S. C.	27,463
Camp Sheridan, Ala	25,907
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Camp Knox, Ky	109,515
Camp McClellan, Ala	38,998
Camp Upton, N Y	22,895
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Camp Sherman, Ohio	2,000
Picric Acid Plant, Fisher Mich	19,900
Camp Grant, Ill	17,500
Camp Columbus, Ga	17,000
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U S General Hospital, Azalia, N. C	5,669
U S General Hospital, Waynesville, N C	600
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Camp Wheeler, Ga	8 691
Camp Fremont, Cal	68,310
Camp Merritt, N. J	22,920
Camp Gordon, Ga	28,828
Camp Pike, Ark	66,093
Camp Taylor, Ky	23,800
Camp Jackson, S. C	63,888
Camp Dix N J	14,540
Gersiner Field, La	21,871
Camp Johnston Fla	56,332
Camp Meade, Md	25,922
Embarkation Camp, Va	16,015
Ellington Field, Texas	21,439
Camp Talliaferro, Texas	11,542
Love Field, Texas	18,408
Camp Devens, Mass	82,428
Camp Kearny, Cal	61 610
Camp Custer, Mich	8,404
Raritan River Ordnance Depot, N J	20,016
Camp Stuart, Va	41,998
Engineer Depot, France	169,414
Eluetta Field, Ark	9,602
Kelley Fields, Texas	94,627
Brooks Field Texas	6,588
Pig Point Ordnance Depot, Va.	10,034
Coastal Aero Station, Fla	1,000
Curtis Bay Ordnance Depot, Md	12,752
Raleigh Tank School, N. C	38,700
Munition Plant, Del	26,400

41,541,300 GALLONS REMCO TANKS

Camp	Gallons
Camp Devens, Mass	400,000
Camp Taylor, Ky	1,000,000
Camp Upton, N. Y	1,050,000
Camp Meade, Md	1,037,000
Camp Pike, Ark	1,800,000
Camp Sherman, Ohio	900,000
Camp Gordon, Ga	1,800,000
Camp Funston, Kan	800,000
Camp Custer, Mich	400,000
Camp Wadsworth, S. C	700,000
Camp Wheeler, Ga	500,000
Camp Cody, N. M	1,000,000
Camp Sevier, S. C	400,000
Camp Shelby, Miss	800,000
Camp McArthur, Texas	200,000
Camp Greene, N. C	400,000
Camp Logan, Texas	400 000
Camp Stuart, Va	1,000,000
Camp Johnston, Fla	400,000
Ellington Field, Texas	80,000
Engineer Depot, France	3,687,500
Love Field, Texas	275,000
Fort Caswell N C	200,000
Pig Point Ord Dep., Va	230,000
Kelley Field No. 1, Texas	100,000
Dorr Field No. 2, Fla	200,000
Ebbetts Field, Ark	100,000
Taylor Field, Ala	100,000
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Mt. Clemens, Mich	120,000
Camp Talliaferro Fields, Texas No 1 No. 2 No. 3	300,000
Fort McHenry, Md	200,000
Coastal Aero Sta., Fla	101,000
Call Field, Tex	100,000
Camp San Juan, Porto Rico	400,000
Gen. Hospital No. 3, N. J	200,000
Fort McPherson, Ga	200,000
Mechanical Repair Shop, Md	200,000
Tuberculosis Hospital, N. Y	420,000
Chemical Plant No. 4, Va	949,000
Park Field, Tenn	100 000
Navy Yard, Pauillac, France	100,000
U.S. Explosives Plant, Tenn	1,004,000
Queenstown, Ireland	100,000
Guantanamo, Cuba	47,000
Payne Field, Miss	100,000
Souther Field, Ga	100,000
Clearing Hospital, N. Y	200,000
Mills Field, Cal	175,000
March Field, Cal	75,000
U S. Explosive Plant, W Va	600,000
U S Hospital, N C	300,000
Q M. Dep., S Schenectady, N Y	400,000
Q M. Dep., E Columbus, Ohio	400,000
Q.M Dep. New Cumb., Pa	400,000
Ordnance Depot, Pa	200,000
Camp Eustis, Va	618,000
Marine Training Camp, Va	1,256,000
Filtration Units, France	1,251,500
Aviation Concentration & Supply Depot, L I	100,000
Camp Perry, Ohio	300,000
Aerial Gunnery School, Fla	200,000
Camp Jones, Aria	100,000
Q M Term., Charleston, S. C	400,000
Raritan River Ord. Dep., N. J.	50,000
Coast Defense, Pensacola, Fla	400,000
Final Testing Field, Dayton, O.	100,000
Scituate Proving Grounds, Mass	100,000
Fort Sill, Okla	1,200,000
Fort Keogh, Mont	100,000
Q M Storage Depot, Mo	40,000
West Point Artillery Camp, Ky.	400,000
Camp Jackson, S. C	1,600,000
Training Camp, Chemical Warfare Service, N. J	100,000
Camp Beauregard, La	1,000,000
Walter Reed Gen. Hospital, Washington, D C	400,000
Tank School, Raleigh, N. C	500,000
Orlana, Va	400,000
Camp Grant, Ill	400,000
Jefferson Barracks, Mo	200,000
Picric Acid Plant, Mich	100,000
Camp Dix, N J	400,000
U. S. Shipping Board, Va	200,000
U. S. Shipping Board, Cal	200,000
Aberdeen Proving Grounds Md	148,000
Camp Knox, Ky	83,000
Filtration Plant	83,500
Picric Acid Plant, Ga	400,000
Filtration Plant, Ark	122,000

AND WE ARE SHIPPING MORE DAILY

Redwood for Durability

REDWOOD MANUFACTURERS CO.
1611 HOBART BLDG.,
SAN FRANCISCO, CAL.

Remco for Mechanical Perfection

Entered at the San Francisco post-office as second-class matter.

Buyers' Guide, Page 44
Advertisers' Index, Page 52

Correction of an Error

In our advertisement in the September 14th issue of the "Mining and Scientific Press," we inadvertently published what now appears to be an error concerning the "approximate weight" of liners used in "any other type of 8-ft. mill", as compared with those used in the 8-ft. Hardinge mills.

As figures have been shown us in at least one instance, indicating that we are in error, we therefore, gladly publish this (paid for) retraction of our statement. Our advertisement also made mention that a crane was required to handle the 8-ft. cylindrical ball mill linings. This broad statement is likewise an inadvertent error on our part due to the hasty wording of our analysis of Mr. Kennard's paper published in the A. I. M. E. Bulletin.

The Hardinge Conical Mill Company has never intentionally published an erroneous statement, and it is far from our desire ever to appear to do so. We will carefully reread some of our other past Ads, and if we note any errors will publicly correct same.

HARDINGE CONICAL MILL CO.

Adverting to the above an error was also made in another advertisement when we stated that—

HARDINGE MILLS
—AT—
NEVADA CONSOLIDATED

ran over one year without relining. The actual running time was slightly over 11 months, or to be exact—

7973¼ Hours
WITHOUT RELINING
(349.8 Tons Per Day)

CAST IRON LINING CONSUMPTION—approximating				**2**	**oz. PER TON**	
"	**STEEL** "	"	"	**½**	"	"
"	**IRON BALL**	"	"	**1 44/100 lbs.**	"	"

The above figures are from an analysis of the paper by Mr. George C. Riser, Supt. Nevada Consolidated Concentrator, read before a meeting of the American Institute of Mining Engineers.

We will be pleased to send you a copy of the paper upon request. It contains details of crushing—unbiased—technical and non-commercial.

Hardinge Conical Mill Co.

NEW YORK
120 Broadway

DENVER
First National Bank Bldg.

"THE 100% MILL"
No Heads—No Grates
ALL PERIPHERY.

SALT LAKE CITY
Newhouse Bldg.

LONDON
Salisbury House

Mining and Scientific Press

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COURTENAY DE KALB, Associate Editor
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Science has no enemy save the ignorant

Issued Every Saturday | SAN FRANCISCO, NOVEMBER 23, 1918 | $4 per Year—15 Cents per Copy

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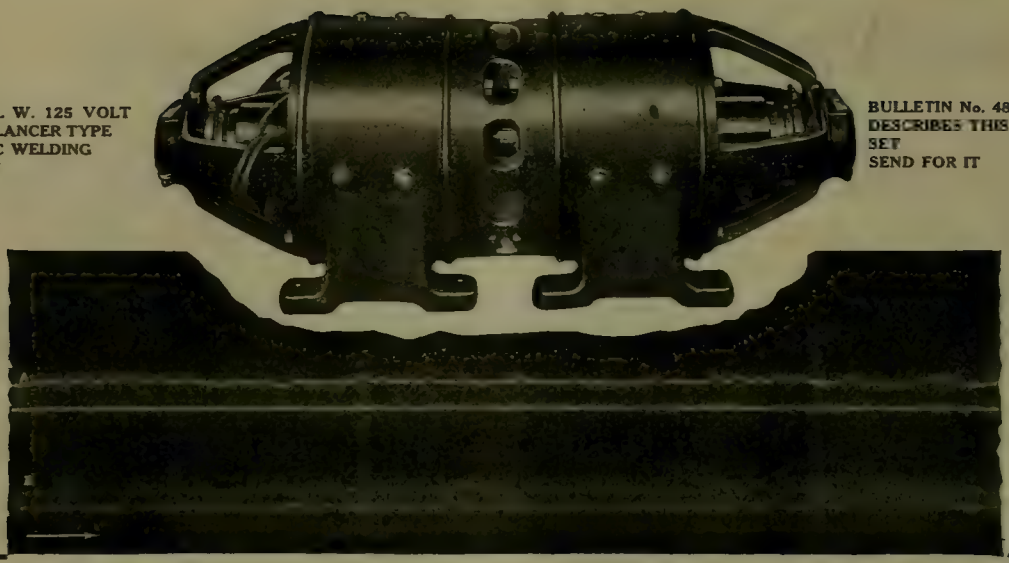
Price, 15 cents per copy. Annual subscription, payable in advance: United States and Mexico, $4; Canada, $5; other countries in postal union, 25s. or $6.

3 K. W. 125 VOLT BALANCER TYPE ARC WELDING SET



BULLETIN No. 48940 DESCRIBES THIS SET SEND FOR IT

Oscillograph curve, showing electrical conditions in welding circuit of constant energy arc welding equipment.
Curve "A" shows current in arc, approximate average value 150 amps.
Curve "B" shows voltage across arc, approximate average value 15 volts.

Steady flow of metal assured by efficient and simple G-E Welders

G-E constant energy arc welding sets are used to secure a steady flow of metal into the weld and high operating efficiency.

A constant flow of metal is assured by the inherent automatic regulation of the energy in the welding circuit throughout the welding range for metal electrodes.

The distribution of welding current between the two units comprising the set and practically dispensing with external resistance in series with arc, assures high efficiency.

One small panel and the set illustrated are all the equipment needed for a one-man outfit where operator has mask and electrode with flexible cable—if 125 volt direct current is available.

Consistently perfect welds are being produced in essential war industries by the use of this equipment.

We are prepared to demonstrate these sets and make good deliveries

43-88

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*Southwest General Electric Company. For CANADIAN BUSINESS refer to Canadian General Electric Company, Ltd., Toronto, Ont.
GENERAL FOREIGN SALES OFFICES: Schenectady, N. Y.; 120 Broadway, New York City; 83 Cannon St., London, E. C., England

CANADIAN casualties are given officially as 311,358, of whom 34,877 were killed in action and 15,457 died of wounds or disease. We salute our good neighbors on the north and congratulate them most respectfully on their splendid service to the great cause.

ONE of our advertising pages is given gratuitously to the propaganda of the Y. M. C. A., which pre-eminently useful organization will have much to do in Europe despite the cessation of fighting. Truck-drivers and automobile mechanics are needed. Read the advertisement.

SETTLEMENT of the litigation between the American Smelting & Refining Company and the Bunker Hill & Sullivan Mining Company is announced solemnly by the 'Boston News Bureau'. This might refer to some new litigation of which we had not heard, but, on inquiry, we find that it refers to the litigation that was settled by compromise, mutually satisfactory, on March 1, as duly recorded in these pages at the time.

EMPLOYERS of labor, more particularly our friends the managers of mines, mills, and smelters, will, we presume, not hesitate to restore technical men that have been in the Army or Navy to the positions that they resigned when they entered the National service. There should be no delay or excuse of any kind for effecting this restoration, even at the temporary expense of the substitutes. The man that answered the call of patriotic duty merits the first consideration.

HINDENBURG is reported to have issued a proclamation in which he asserted that the German army finished their fight with "heads proudly erect." This only proves how little he realizes that, in the eyes of the world at large, he and his army have been dishonored by their campaign of frightfulness. They fought bravely and tenaciously, but they lost the honor that might have been left them in defeat by having used methods worthy of savages. Their honor is forever besmirched by their dirty doings.

CESSATION of hostilities has not caused a violent slump in the stock market. The memory of the panic that occurred when the war began in Europe had led many to fear that the abrupt readjustment to peaceful conditions would be disastrous to share quotations on Wall Street. The cancellation of contracts with the makers of munitions has depressed the 'War babies', naturally, but this decline in prices has not affected the peace stocks, which are steady, if not buoyant. This suggests a quiet return to normal financial conditions.

BRIEY has been re-occupied and the whole of the Longwy-Briey iron district is again in the hands of the French. Our readers will rejoice at the news, for they know how essential these deposits of iron ore are to the industries of France. Still better, with the hoisting of the tricolor in Lorraine the French regain the extension of these deposits into the old province and will re-possess a splendid industrial asset. As we have stated before, the winning of Lorraine should increase the French production of iron ore to 43,000,000 tons and decrease that of Germany to 7,500,000 tons per annum.

MOCK heroics should not be allowed to influence the choice of a punishment for William of Hohenzollern. The talk of St. Helena strikes a false note. When Napoleon was conquered he retired into exile with the respect of all soldiers and of most civilians for the way in which he had fought; he retained the loyalty of his own people and received the honors due to a great enemy from those that had fought him so long. The Kaiser's picture will fit no such gilded frame. If he and his six sons had shown military capacity and had risked their lives in battle, they would seem less despicable today. The late Kaiser is a criminal at the bar of justice, not a hero for an international cinema.

VARIOUS rumors are current concerning the steps to be taken to protect the production of gold. It is said that the Chamber of Mines in the Transvaal has suggested that the British government contract to buy all the gold produced on the Rand during the next ten years at an advance of 10 shillings, or $2.50, per ounce upon the price hitherto established. The London Chamber of Commerce recently passed a resolution stating that the production of gold was an essential war industry and ought to receive preferential treatment by the Government. It is too early to detect the effect of peace on the status of gold, because, although active warfare has ceased, the enemy countries are not yet in a position to

trade with the rest of the world, and until trade relations are established afresh we shall not know to what extent they will involve an increased use of gold.

PRICES of metals will undergo some measure of readjustment now that hostilities in Europe have ended and the demand for munitions has ceased abruptly. We understand that 450,000,000 pounds of copper is in transit and unmarketed, the largeness of the quantity being due to the shortage of capacity at the refineries, the general shortage of labor, and the crippling effects of the influenza epidemic. The producers of copper have suggested to the Government that it should buy all this floating supply of copper at the official price and then leave the market open to business without any further attempt at regulating prices. As to lead, it is interesting to note that a shipment of 500 tons of lead from the Bunker Hill smelter, in Idaho, to the Union Iron Works, in San Francisco, was countermanded by the Government while on its way hither on the day that the armistice was signed. The floating supply of lead is small and the market conditions are believed to be healthy.

IT is reported that when the terms of capitulation were read by Marshal Foch to the German delegation, one of them, Dr. Mathias Erzberger, said: "Marshal, have you any sympathy for the German populations?" This same delegate, it is stated, sobbed when he signed the protocol. We would have liked to have taken him to certain parts of Belgium, say, Dinant, Louvain, or Termonde, and then to parts of evacuated France, then to Serbia, and we would have asked him to sob again. The Germans are in a sorry plight and now that they are thoroughly beaten, the Allies will be humane enough to aid in preventing famine within their disordered country, but it is in no spirit of vindictiveness, but of bare justice, that we remind them, in their dark hour, of the misery that they brought on innocent civilian populations during four long years when they imagined themselves able to over-ride all sentiments of humanity.

ON his departure for Europe, Mr. Hoover takes with him the continued good wishes of the profession. His work as Food Administrator has won general public support and commendation, which is fully confirmed by the results achieved. It will not be long before the Food Administration at Washington will cease to exist, transferring its surviving duties to the Department of Agriculture, therefore the President has asked Mr. Hoover to go to Europe, where an organization for alimentation on a large scale will be required at once. As Mr. Ralph P. Merritt, the efficient Food Commissioner for California, has said recently: "The call of humanity is more insistent in the hour of victory than before the war began." It will be a keen pleasure to Mr. Hoover to revisit Belgium and see for himself the beneficent results of his own initiative in 1914, but now he will widen his sympathy and enlarge the scope of his work so as to cover many other countries, even those with which we have just been at war and with which technically we are at war still. The mining profession unites in wishing him god-speed and in hoping that he may retain the good health required to perform his colossal task.

NON-PARTISAN citizens, we believe, have accepted the result of our recent khaki election with satisfaction, because a Congress so closely divided between the two parties will prevent the passing of any legislation that does not commend itself to the good sense of the country as a whole. As we interpret the election, it was not so much a rebuke to the President for his political manifesto as to the volunteer regulators by whom the President has been surrounded during the last two years. The people of the United States are easily irritated by any suggestion of autocratic methods. We are glad that Mr. Ford "expects to resume the manufacture of pleasure-cars as fast as he is released from war contracts," because that enterprising gentleman is so much better fitted for making standardized machines of transport than for the duties of a legislator. His lack of the qualities of a statesman, or even a politician, were clearly demonstrated by the peace expedition that he sent to Europe so inopportunely. It is one of the vagaries of human nature to suppose because a man is pre-eminently effective in one branch of human activity that he must also be well qualified for other activities of an entirely different character. This is shown by the choice of admirals, generals, or even bankers, as directors of mining companies. We recall the mining fiascoes connected with the names of Lord Dufferin in London and of Admiral Schley in New York. 'Let the shoemaker stick to his last.' Mr. Ford is more useful at Detroit than at Washington.

Chromite—and Manganese

In our issue of November 9 we published a telegram from Mr. H. W. Sanford, chief of the Ferro-Alloys Section of the Chemicals Division of the War Industries Board, in which he referred to the "misconception in the minds of some chromite purchasers," who had interpreted his telegram of September 27 to mean a guarantee of sale "for the balance of this year and the first half of next year." On September 27 Mr. Sanford telegraphed to Mr. Frederick J. Koster, President of the San Francisco Chamber of Commerce, stating: "It is the present intention of the War Industries Board to arrange for continued chromite production in the United States for the first half of 1919 at a rate proportionate to the rate of 1918 production and the trade will be asked to purchase chromite of suitable grade produced in the United States during the first half of next year at this rate. No announcement can be made regarding prices. Believe tonnage of domestic chromite produced during the balance of this year can be sold at the average prices paid this summer by the California Chrome Company. If unable to find ready market for ore wire this office giving tonnages ready for immediate delivery and guaranteed analysis and prices wanted and to whom already offered

and refused. Chemical refractories and steel trades likely buyers." This telegram afforded ample reason for the belief that a market for chrome was assured for "the balance of this year and the first half of next year," and we do not see that any unwarrantable "misconception" existed in the minds of the producers. The suggestion to "wire this office" for assistance in marketing Californian chromite, provokes a derisive smile, knowing, as we do, the nature of the help given by Mr. Sanford and the Electro-Metallurgical Company to the producers of chrome and manganese on this Coast. Why did he not warn local producers months ago that there were signs of a glutting of the market? Why were the producers kept in the dark concerning the fact that the electro-metallurgical consumers—a small group—had accumulated a supply sufficient for ten months? For what interest did the California Chrome Company, the representative of the same group, act, for patriotism or profiteering? Eight months ago this company made a big splurge and advertised freely its willingness to buy ore for the remainder of the current year at higher prices than had been prevailing. Within four months they had driven all other buyers out of the market and achieved a position such that their manager could brag that he had the producers in the hollow of his hand. Then, having cinched the chrome industry of the Pacific region, the California Chrome Company suddenly ceased buying; they said that the price had not gone down but that they were out of the market, thereby opening the way for others to make lower bids. When an appeal was made to Mr. Sanford, he sent lists of buyers. Many producers tried this list, the result being the sale of one carload and sundry offers of lower prices. Nor have the manganese producers fared much better. The unfavorable schedule prepared by the committee of the Iron & Steel Institute, the same group of ferro-alloy dealers and consumers, Messrs. Price, Lavino, et al., drove a number of miners from the exploitation of manganese to that of chrome. The same antics marked the stimulation and subsequent depression of the manganese industry, which is now in a precarious condition. In all these manœuvres there appears unmistakable evidence of a purpose: to kill any industry on the Pacific Coast that would interfere with the control of the electro-metallurgical group at Niagara. Quite recently Mr. C. M. Weld, a representative of the Bureau of Mines, has been placed on the ferro-alloys committee. This is an example of shutting the stable when the horse has gone; it ought to have been done long ago; it was a blunder to allow the committee to consist wholly of the representatives of the consumers. The entire affair is a disgrace to the War Industries Board, which has permitted the ferro-alloy group to do much as they liked. It appears to us that the Bureau of Mines has been used as a cat's paw and that the Administration has been discredited. It should be clear to any fair-minded man that a moral equity exists as between the Government and the producers of chrome ore. It is true, the War Minerals Bill does not provide for this exigency, for it is not retroactive and it only applies to a scarcity of minerals, not to an unfortunate position created by an over-supply. This, however, should not debar the President from acting in the matter; he has an emergency fund, now something like $50,000,000, out of which he could reimburse the chrome producers for their losses, amounting to about $1,500,000.

As we go to press we learn by telegram from Washington that the President, by executive order, has placed the War Minerals administration in the hands of the Bureau of Mines, where it rightly belongs. Consumers are still trying to break through the order prohibiting imports of cheap chromite from New Caledonia. It is estimated that the consumption is 95,000 tons and the domestic production 75,000 tons per annum, so that there is no excess of domestic ore. Stocks are said to be not excessive considering the plans of the Government for sustaining industries. No shipping is available for importing minerals, and restrictions on automobile manufacture have been removed, thereby re-establishing an important channel of consumption. The demand for chrome is likely to be larger next year and under the War Minerals Act the purchases by the Government can be protected by duty; in short, conditions favor the absorption of the American production if the War Minerals Act is administered firmly, as we may now expect. We hope to publish further information at an early date.

The Terms of Capitulation

On November 12, the day after the armistice was signed, Dr. W. S. Solf, the Secretary for Foreign Affairs at Berlin, sent a message asking the President to intervene for the purpose of mitigating the harshness of the terms that the representatives of Germany had been compelled, by force of circumstances, to accept. With his sophisticated argument we have nothing to do, nor need we inquire into the motive prompting this appeal to one of the belligerents instead of making it to the chief of the Allied forces, but it may be well to consider the terms of the armistice in the light of expressions of opinion made publicly by various leaders of the German people at the time when they thought themselves likely soon to be in the position of formulating terms as victors to the vanquished. The former Financial Secretary, Herr Helfferich, speaking in the Reichstag, said: "We have financed this war on the presumption of winning it and that the indemnities to be exacted from our defeated enemies would fully reimburse us and defray the expenses thereof, and that they, the conquered nations—not we—would drag around or carry on their shoulders the burden of the leaden billions." This, of course, is in harmony with the ideas expressed by Bernhardi and other German writers before the War, all of whom made it clear that the cost to the German government of subsidizing industry and of promoting the industrial invasion of foreign countries would be reimbursed on the occasion of the next successful war, the victims of which were indicated without compunction. Unfortunately for the Germans their predatory scheme did not work out as

was expected and the burden of defeat now falls upon them instead of being laid upon those whom they so wantonly attacked. Soon after the unrestricted U-boat campaign was started Von Tirpitz said: "I hold the English fleet in the hollow of my hand and will have England on her knees within sixty days. We shall then exact such terms of surrender as will satisfy the Imperial German government. One condition will be that England will deliver to Germany intact her entire fleet, which later will be manned with good German sailors and will sail across the Atlantic to the big, fat, rich cowardly nation, the United States, and she will be compelled to pay the bill." This authentic statement of the head of the German navy should soothe the tender sensibilities of those who are inclined to consider the terms of capitulation too severe. However, we have other trustworthy testimony to the German idea of the terms they thought it would be proper to exact if they won. Dr. Oppenheimer said: "If we win, we must utterly destroy the power of England; we must take her colonies and her fleet. We might take the French fleet, too, and make France bear the cost of the war. Belgium could be joined to Germany." This exponent of kultur had the good sense to preface his fulmination with an 'if', which proved more significant than the rest of his declaration. Count von Reventlow, a publicist whose name has become familiar to most of us during the War, said: "Our statesmen must in the peace negotiations be men of iron and not resemble soft wood painted iron-gray. The German people mean not only to hold out but to conquer." Apparently he and his friends, if placed in the position of Marshal Foch and Admiral Wemyss, would have paid scant attention to any such appeal as that forwarded by Dr. Solf to President Wilson. In the November 'Atlantic,' Mr. P. H. Chadbourn quotes one of his German hosts, a party of explorers at Babylon, as saying: "Mark my word! The next time we go into France we will take it all, I say, to the Channel and to the Mediterranean. But we may give back Paris, perhaps, for to Germanize it would spoil it. . . . Yes, we will draw a circle around Paris, and keep it *tout-à-fait Parisienne*—a place where we can amuse ourselves when our serious work is done." What the nature of that "serious work" would be, we can infer from the experience of Belgium. The dethroned Kaiser, now interned in Holland, told Ambassador Gerard that "America will have to look out after the war; I shall stand no nonsense from America after this war." Again we need not indulge in much guessing as to what might have been the punishment that the Hohenzollern would have visited upon America, whose military resources he so fatally under-estimated. We know what the Germans would have done to the rest of the world if only they had succeeded in their mad onslaught, for do not Russia, Rumania, and Belgium supply the damning proof? They debauched the Russian government, they stole the food of the Russian people, they crushed them to the earth until their very manhood was gone. In Belgium, they levied punitive fines on the cities, they looted private homes, they enslaved the able-bodied men. In France, so long as they occupied a part of it, they perpetrated every conceivable act of systematic brigandage and savagery. What they would have done is recorded in the petitions of their intellectuals to the Government: "It is necessary to impose a mercilessly high war indemnity on France and not forget her colonial possessions." Again: "The security of the Empire in a future war requires the ownership of all mines of iron ore, and to defend them the fortresses of Longwy and Verdun." They intended to evacuate the native populations of the countries they had invaded, perpetrating a crime against which civilization would have protested in vain. In 1916 General Von der Kries said: "This country [Poland] was meant for Germany. We propose to remove the able-bodied Poles, to leave it open to the inflow of Germans as fast as we can spare them. They will occupy and work it. By and by we shall give back Poland, and it will then be automatically a German province." It is no wonder that Nietsche said: "Deep in the nature of this race there lurks unmistakably the beast of prey; the blond beast lustfully raving in search of booty and victory." The "blond beast" has been frustrated and now he whines because he has to take his medicine, a medicine that is intended to be an effective preventive to another fit of "lustful raving in search of booty" at the expense of his neighbors. Out of their mouths let them be judged. Justice is a higher quality than sentimentality. The German need never fear we shall treat him as he would have treated us, but we intend to protect ourselves from the danger of further depredation on his part and we desire to make him see the error of his ways. To Dr. Solf's plea for food, the President replied, through the Secretary of State, that the people of the late German Empire would be supplied with food and their distress relieved by the Allied governments "provided he can be assured that public order is being, and will continue to be, maintained in Germany and that an equitable distribution of food can be clearly guaranteed." And what shall be said of the appeal made by German women to the President's wife? At first it softens one's heart, for any man hates the idea of bringing suffering upon women or children; but Justice places her firm hand on Pity's shoulder and reminds her that the women of Germany treated our prisoners vilely, nor did they raise the slightest protest against the starving of the women and children of Belgium. We have no reason to believe that they would have asked the Kaiser to be gentle if the British navy had been rendered impotent by his submarines or if his gray host had overrun France. The women of Germany do not need Mrs. Wilson's intercession, they will be treated much better than they deserve. The victors in the great contest now ended will do for the vanquished what it is certain the vanquished, if the position had been reversed, would never have done for them. In this, as in other matters, we shall not follow the precepts of kultur but those of civilization. The one is the glorification of national conceit and military rapacity, the other is the emergence from the jungle and the spiritual growth of humanity.

Process for Recovering Platinum

The Editor:

Sir—Mr. V. J. Zachert deserves the thanks of the profession for his interesting article in your issue of October 12, describing his new method of separating platinum from 'black sands'.

I have not had opportunity to test the process, so cannot comment on its application, chemically, but feel constrained to make some comment on the mechanical details, apparently necessary for the success of this, or for that matter any other, method.

Mr. Zachert proposes to amalgamate his sand in an acid solution containing also copper sulphate, and by the use of zinc amalgam; it is evident that to do this in the ordinary course of either dredging or hydraulic operations would be impossible owing to the amount of water in constant circulation. Hence we must concentrate the sand in some way, before submitting it to this process, and Mr. Zachert is good enough to recommend the Neill jig for the primary step in this concentration, which he describes as "a rough concentration" from which a "sand-concentrate can be produced averaging 75 cents to $1 per ton."

Right here it must be stated that Mr. Zachert has overestimated the degree of concentration commercially possible with the Neill jig as now used on dredges and in the 'undercurrents' of hydraulic mines; in both cases the material passing into the jigs carries values of not more than three cents per yard, oftener much less, and as it is desired to make a clean tailing, regardless of the quantity of the concentrate produced, it is customary to bed the jigs so as to make from 1000 to 1500 lb. of concentrate per jig per hour, and this material is carried from the jig through openings averaging ⅜ inch in diameter, which deliver about 20 to 24 gal. of water per minute.

As the jigs handle from 10 to 15 tons of sand per hour, it will be seen that the degree of concentration usually attained is about 20:1, or, if we should save all the contents of the heading in the concentrate it would not run over, say, 60c. in gold, and a very small fraction of this value in platinum. In a former issue of your paper I have shown that on the Yosemite dredge we saved in the riffle system 0.25c. per yard of bank dug, and the tests described indicated a loss of possibly twice as much more; but, this loss when calculated on the yardage of material passing through the screens, and so over the riffles, would make a platinum content of about 1c. per yard as a maximum, and if all this were saved in the jig-concentrate a value for these of 10c., associated with the above 60c. in gold. This estimate of 1c. is based on only one series of tests, and is no doubt much above the average of the value of usual dredging work.

It is evident that the application of Mr. Zachert's chemical method to the handling of this large mass of material is not practicable, certainly not on board a dredge-boat, and hardly at a hydraulic mine.

The dredges at Folsom, California, are equipped with eight jigs each, and they are equipped with ball-mills, one on each side, to grind and polish the jig-concentrate before amalgamation, and these mills handle from 40 to 60 tons per day, an effective de-watering being accomplished by the scoop-feeders. For a plant designed to use the Zachert method, it would be necessary to have reasonably clear water, so as to maintain the desired acidity; this is not obtainable on a dredge-boat, the pond-water being oftener thin mud than clear water. Therefore, it would be necessary to re-concentrate the jig-concentrate on board the dredge, bringing it up to a point where it is nearly pure black sand, this to be caught in proper boxes, drained, sacked, and removed from the dredge, for the Zachert process to complete the treatment on the solid earth.

In my previous article I have shown that it is possible to run a Wilfley table on board a dredge, but it is a difficult operation, it would require close adjustment and close watching, and it would take a large area on deck for the tables, which have a capacity of not over 25 to 39 tons each.

None of these objections apply to the jig, and there is no reason why the jig-concentrate might not be elevated to an upper deck, and there run over another jig, one of which would handle the output of all the others (eight) on the dredge. By proper and easy adjustments this second jig may be made to produce a practically pure black-sand concentrate, it would require but little attention or adjustment during the ordinary day's run, it would take very little deck-space, little power, and no clean water. This mechanical equipment would produce the concentrate desired by Mr. Zachert for his process, and his manipulations would be carried out in a proper plant, and under proper conditions away from the troubles of the dredge or hydraulic sluice.

As to the possibilities of losses being incurred in this re-treatment of the jig-concentrate, it may be said that any gold or platinum, or indeed any other metal or mineral, that is saved by the primary jig out of the

dredge or hydraulic sluice, will certainly be saved in the second operation, as this jig will receive a perfectly sized feed, with only the amount of water needed for the best working of the machine, and with all other conditions better than is possible on the primary jigging operation.

JAMES W. NEILL.

Salt Lake City, November 7.

Formulas for Mine Valuation

The Editor:

Sir—The mining world certainly is indebted to W. W. Whitton for his excellent article on 'Formulas for Mine Valuation' in the MINING AND SCIENTIFIC PRESS of May 18. It is seldom that one has the privilege of reading such a detailed discourse on the derivation of mine-valuation formulas. The able discussion of Whitton's article by D. B. Morkill in your issue of August 31 brings out another phase of the matter, and both articles are worthy of careful consideration. The derivation of the Hoskold or of any other mine-valuation formula, although not difficult, nevertheless requires a careful manipulation of arithmetic and algebra. Most of us are prone to take the formulas for granted without going into the why and wherefor of them. The common method in use by engineers is to take the values as given in Hoover's excellent 'Principles of Mining', and consider the matter ended. The tables given by Hoover were developed by the use of what was originally known as the Hoskold formula. In the past little thought has been given to the possibility that these tables might be in error. I doubt whether many mining engineers have ever tried to reason out and derive the formula as is so ably done by Whitton. After 40 years the formula and tables are called in question, and they either must be supported and proved correct or another must be adopted.

Let us therefore compare the three formulas, as given by Morkill, and consider the merits of each, using as far as possible the same notation, namely:

j = rate at which the sinking-fund is to be placed at interest.

i = rate to be realized on the mining investment.

d = amount of annual dividend in dollars.

n = years of life of the mine.

I shall use three different V's as follows:

V_H = present value of the investment by the Hoskold formula.

V_W = present value of the investment by the Whitton formula.

V_M = present value of the investment by the Morkill formula.

In the case of V_W and V_M, it seems that they really indicate the present value of the profit on the ore remaining in the ground at the particular time in question, and not the value of the investment.

Using the special case, as was done both by Whitton and by Morkill, we have a mine with an expected life of 10 years, paying an annual dividend of $1000, the rate allowed on the investment being 10% and the redemption-fund drawing an interest rate of 4%. Throughout this article these values and results will be used enclosed in parentheses.

The three formulas are as follows, with the investments computed from them:

$$\text{Hoskold, } V_H = d\,\frac{(1+j)^n-1}{(1+j)^n i - i + j} = \$5455.81 \qquad (1)$$

$$\text{Whitton, } V_W = d\,\frac{(1+i+j)^n-1}{(1+i+j)^n i + j} = \$6591.37 \qquad (2)$$

$$\text{*Morkill, } V_M = d\,\frac{(1+i)^n-1}{(1+i)^n - i} = \$6144.58 \qquad (3)$$

By using the above three formulas, three tables can be calculated, as given in the Morkill article, and repeated here for use in the discussion.

Hoskold Table 2

Year	V_H	d	$V_H i$	$(d-V_H i)$	Amount in sinking-fund
1	$5455.81	$1000	$545.58	$454.42	$454.42
2	5455.81	1000	545.58	454.42	972.02
3	5455.81	1000	545.58	454.42	1418.52
4	5455.81	1000	545.58	454.42	1929.68
5	5455.81	1000	545.58	454.42	2461.28
6	5455.81	1000	545.58	454.42	3014.15
7	5455.81	1000	545.58	454.42	3589.14
8	5455.81	1000	545.58	454.42	4187.12
9	5455.81	1000	545.58	454.42	4809.03
10	5455.81	1000	545.58	454.42	5455.81

Whitton Table 2

Year	V_W	d	$V_W i$	$(d-V_W i)$	Amount in sinking-fund
1	$6591.37	$1000	$659.14	$340.86	$340.86
2	6250.51	1000	625.05	374.95	729.44
3	5861.93	1000	586.19	413.81	1172.42
4	5418.94	1000	541.89	458.11	1677.43
5	4913.93	1000	491.39	508.61	2253.13
6	4338.22	1000	433.82	566.18	2909.44
7	3681.91	1000	368.19	631.81	3657.62
8	2933.72	1000	293.37	706.63	4510.56
9	2080.78	1000	208.08	791.92	5482.90
10	1108.44	1000	110.84	889.16	6591.37

Morkill Table 3

Year	V_M	d	$V_M i$	$(d-V_M i)$	Amount in sinking-fund
1	$6144.58	$1000	$614.46	$385.54	$385.54
2	5759.04	1000	575.90	424.10	809.64
3	5334.94	1000	533.49	466.51	1276.15
4	4868.43	1000	486.84	513.16	1789.31
5	4355.27	1000	435.52	564.48	2353.79
6	3790.79	1000	379.08	620.92	2974.71
7	3169.87	1000	316.99	683.01	3657.72
8	2486.86	1000	248.68	751.32	4409.04
9	1735.54	1000	173.55	826.45	5235.49
10	909.09	1000	90.91	909.09	6144.58

Morkill also calculated the interest-return to the investor based on the original amount of the investment for each of the three formulas. The results are given in the following table:

*It seems that there must be an error in the Morkill formula as printed in the 'Mining and Scientific Press' of August 31, for I find by derivation, based on Morkill's assumptions, that the resulting formula should be:

$$V_M = d\,\frac{(1+i)^n-1}{(1+i)^n i} = \$6144.58 \quad (3A)$$

The last expression for the formula will be regarded as correct in this discussion.

Table 4

Year	Hoskold %	Whitton %	Morkill %
1	10	10.00	10.00
2	10	9.48	9.62
3	10	8.89	9.21
4	10	8.22	8.75
5	10	7.45	8.24
6	10	6.58	7.70
7	10	5.58	7.09
8	10	4.45	6.43
9	10	3.16	5.69
10	10	1.68	4.89

NOTATION. Before examining the formulas and tables it will be advisable to look over the notation and study the meaning of each. (1) i = the rate to be realized on the mining investment. I believe that it would be better to say that i expressed the rate of the annual dividend. This is indicated in Table 1, page 46 of Hoover's 'Principles of Mining.' (2) d = the amount of annual dividend in dollars. My understanding of annual dividend is that it is the amount of money paid to an investor on his share in a property. I would prefer to let d = the amount of annual net profit in dollars from the ore or property; d is then made up, as is easily noted, of two parts, namely, the annual dividend in dollars, Vi, and the annual amount set aside in the sinking-fund, d-Vi. (3) V = the present value of the investment. This statement is true for the Hoskold formula and table, but it seems that it is used incorrectly in the Whitton and Morkill tables, for they both allow it to decrease. From their values for V in the tables, it seems that they intended V to equal the present value of the profits on the ore remaining in the mine. Surely it is unreasonable to say that the present value of an investment during the tenth year is equal to $1108.44 as given by Whitton, or $909.09 as given by Morkill, when Whitton also has $5482.90 and Morkill $5235.49 in their respective sinking-funds.

FORMULAS. Hoskold's formula is based on: (1) A constant value, V_H, for the investment throughout the life of the property; (2) a constant rate of interest, i, (10%) in the specific case given; (3) this results in a constant return, $V_H i$, from the investment; (4) equal amounts, d-$V_H i$, are thus put aside in a sinking-fund at a safe rate of interest, j, (4%) which will return the amount of the original investment ($5455.81) at the end of the specified period of 10 years.

Whitton's formula takes into account: (1) A decreasing value, V_W, for the investment; (2) a constant rate of interest, i, (10%) on this investment; (3) the result is a decreasing return, $V_W i$, from the investment; (4) increasing amounts, d-$V_W i$, are put aside in a sinking-fund at a safe rate of interest, j, (4%) which will return the amount of the original investment ($6591.37) at the end of the specified period of 10 years.

Morkill's formula follows much the same reasoning as that in Whitton's. (1) A decreasing value, V_M, for the investment; (2) a constant rate of interest, i, (10%) on this investment; (3) the result is a decreasing return, $V_M i$, from the investment; (4) increasing amounts, d-$V_M i$, are put aside in the sinking-fund, which, without the interest, return the original investment ($6144.58) at the end of the specified term of 10 years; (5) we find later on that the sinking-fund is placed at interest, j, (4%), which is paid to the investors annually to increase their return from the investment.

A comparison of the first three tables reveals the following: Hoskold's table shows a simple distribution: (1) A constant value for the investment, V_H, ($5455.81). The amount of profit to be obtained from the ore unmined is constantly decreasing, but a corresponding increase in the sinking-fund takes care of this and therefore accounts for the constant value of the investment. (2) The annual amount realized from the investment, $V_H i$, ($545.58) is constant. (3) The annual amount set aside in the sinking-fund, d-$V_H i$, ($454.42) is constant. (4) The amount in the sinking-fund draws a safe rate of interest, j, (4%), which at the end of the specified period totals the amount of the original investment ($5455.81).

Whitton's table shows a changing distribution: (1) A decreasing value of the investment, V_W, ($6591.37 to $1108.44). (2) A corresponding decrease in the return from the investment, $V_W i$, ($659.14 to $110.84) due to the decrease in V_W. (3) An increase in the amount set aside in the sinking-fund, d-V_W, ($340.86 to $889.16). (4) The amount set aside in the sinking-fund draws a safe rate of interest, j, (4%), which is sufficient, when added to the principal, to return the original investment ($6591.37) at the end of the specified period of 10 years.

Morkill's table follows a similar method of distribution to that of Whitton except in the method of handling the interest from the sinking-fund: (1) A decreasing value of the investment, V_M, ($6144.58 to $909.09). (2) A corresponding decrease in the return from the investment, $V_M i$, ($614.46 to $90.91) due to the decrease in V_M. To this should be added the interest obtained from the sinking-fund as indicated in table 4. (3) An increase in the amount set aside in the sinking-fund, d-V_M, ($385.54 to $909.09). (4) The amount set aside in the sinking-fund, without interest, will equal the original investment ($6144.58) at the end of the specified period of 10 years. (5) The Morkill table leads one to believe that the sinking-fund does not draw interest. However, we find, by table 4, that the interest from the sinking-fund, at a safe rate, j, (4%) is taken in as a part of the return on the investment.

In table 4 a comparison of the three formulas and tables is given, based on the annual percentage-return to the investor on the amount of his original investment. Hoskold has a constant return of 10%; Whitton decreasing from 10% during the first year, to 1.68% during the last; and Morkill with the interest from the sinking-fund added, decreasing from 10% to 4.89% at the end of the period of 10 years.

SUMMARY. The three formulas are similar in at least a few respects. (1) They all provide for a return of the original amount of the investment at the end of the same period, namely, 10 years. (2) They all allow the

same rate of interest, *i*, (10%), on the present value of the investment as interpreted by each. (3) They all provide for a safe rate of interest, *j*, (4%), on the sinking-fund. Although the Morkill formula does not show this, nevertheless, Morkill uses the interest to pay an increased amount to the investors annually. The three formulas differ in a number of respects. The present value is constant in the Hoskold formula and table, and decreasing in the other two. In the Whitton, the present value is 20% greater than in the Hoskold at the beginning of the period, while the Morkill formula gives a present value 12.5% greater than the Hoskold. The result in the case of Hoskold is an equal annual return to the investor throughout the life of the mine, while in both the other cases the annual return is greater at the beginning of the period, and decreases to a minimum at the end. Finally, the amount placed in the sinking-fund is the same for each year in the Hoskold, while the Whitton and Morkill formulas indicate an increasing amount for each succeeding year.

CONCLUSION. From the standpoint of the investor, the value of the property is less by using the Hoskold formula, and this means a smaller original outlay to acquire the property. The interest, *i*, paid on this investment is uniform throughout the life of the mine, and equal amounts are set aside annually in the sinking-fund. The Whitton and Morkill formulas on the other hand give a greater value for the property, and the result is that a larger amount of money is needed in the original investment to acquire the property. The return on this amount is equal to *i* (10%), at the beginning of the period and then rapidly falls off, reaching a very small per cent during the last few years of the life of the mine. The effect of this on the investors can be readily foreseen, for when the decreasing returns become great the market-value of the investment will be decreased, although the investment is protected with a sinking-fund, and dissatisfaction will naturally result. Another point against the Whitton and Morkill formulas is the fact that, as the property is approaching exhaustion, the amount set aside in the sinking-fund reaches its maximum with over 90% of the profits turned into the sinking-fund during the last year. It is worthy of note, at this point, that the last two formulas, by their method of putting money into the sinking-fund, lose approximately 10% of the interest obtained by the Hoskold formula, and this is one of the factors that helps to increase the amount of money required by them. The owner of a property, who desires to dispose of it, may favor the Whitton and the Morkill formulas, because they would bring him a greater amount of money. He has good reason to be satisfied, but, I should like to know how he will be able to explain the decreasing returns based on the amount of money invested, and the increasing amount that must be set aside in the sinking-fund as the amount of ore decreases. If he can explain these points to the satisfaction of the party interested in the purchase the formula will meet with his approval, but the investor will be hard to satisfy in this respect.

Reviewing the merits of the three formulas and their weaknesses, I feel that they weigh most strongly in favor of the Hoskold formula, which gives a simple distribution of the profits and an unchanging return on the original investment rather than a decreasing one, and a possibility of increase if new orebodies are developed. With due respect to Whitton and Morkill for their excellent work, I recommend that we continue to accept the formula and table originally developed by H. D. Hoskold.

El Paso, Texas, October 2. H. D. PALLISTER.

The Value of Gold

The Editor:

Sir—It is somewhat of a joke, but at the same time tragic, for the small producer of gold (I mean the real little fellow), to have read of the shortage of this metal, and how the Government, and various mining institutions were endeavoring to devise some satisfactory means of relieving and helping the gold miner, he receives a 'knock out' from the smelter in the shape of a reduction of 50c. per ounce on the value of the gold he ships.

I have shipped in the neighborhood of 60 to 70 small parcels of zinc precipitate from this district, and in no case has the smelter paid less than $20.50 per ounce for the gold. This is a small property worked by three partners, who for the past three years have had a struggle to make ends meet. The first parcel of precipitate that I shipped to the smelter paid, after the usual deduction of 2½%, $20.50 per ounce, but for the following one shipped on October 3 they have deducted the usual 2½% and pay $20 only for the gold.

P. R. TURNER.

Tuber Canyon, California, November 4.

In Memoriam

The Editor:

Sir—Your issue of the 26th mentions the visit of C. E. Watson and G. O. Randolph to the Engineer mine near Atlin. You have, of course, the news of the disaster to the ship 'Princess Sophia' near Juneau. As I am familiar with the object of that visit and the personnel of the party that included those men I thought you might be interested in an authoritative statement.

The party that boarded the 'Sophia' at Skagway included, besides Messrs. Randolph and Watson, Capt. James Alexander and his wife, Clarence S. Verrill, a mining engineer of Vancouver, B. C. Mr. Verrill was a prominent engineer of 20 years experience in Colorado, California, Idaho, and B. C. He was identified with the recent deal which brought about the sale of the Surf Inlet mine. He held the option that was taken up by the Tonopah-Belmont company. He was a man of high ideals and a clear record, and an honor to the profession. He was a Yale man, the son of Prof. A. E. Verrill, who has been identified with the university for upwards of fifty years. Capt. Alexander was the owner of the famous Engineer mine in the Atlin district.

WAYNE DARLINGTON.

Georgetown, South Carolina, October 30.

Well-Drill Blasting

By J. C. COSTELLO

An exhaustive study has been undertaken in order to ascertain and point out as far as possible the element of danger that exists during the operation of loading and shooting 'sprung' holes. The main purpose of the investigation centred upon that common class of blasting, generally known as 'heavy sprung' well-drill holes, a class of work that has come into being and is now largely employed by practically all the large copper-producing companies in the West.

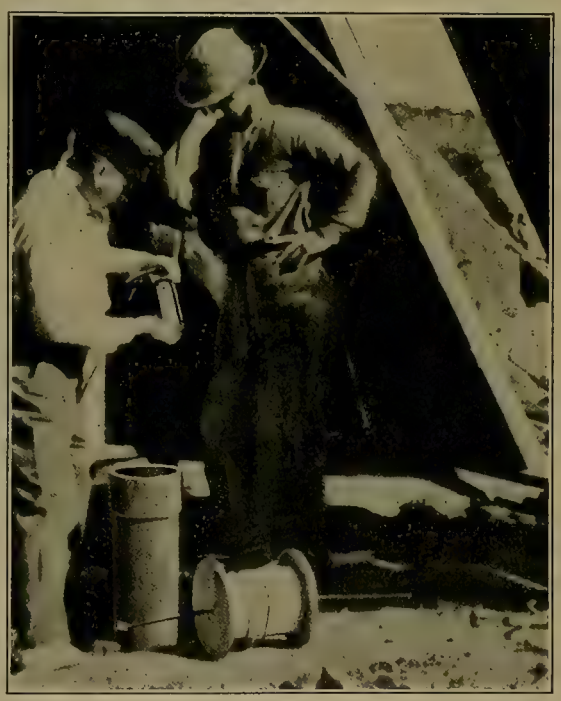
It is generally recognized that the ideal manner of shooting well-drill holes is under the so-called 'straight' method, that is, loading high in the barrel. Springing deviates largely from the original idea of shooting away from the bank, leaving the holes clean cut throughout their entire length and sheared from top to bottom. Instead of producing such a condition with sprung holes, the mass in reality is simply raised and dropped. No doubt both methods offer advantages dependent upon the field conditions. The straight method is to be recommended, first, as simple and safe for the reason that no foreign heat is injected into the hole by the explosion. Again, no heat is created by friction through the compression or rending of the rock caused by springing; second, loading high in the barrel no doubt breaks the mass smaller and in more uniform sizes, for the reason that a larger amount of the charge is in direct contact with the mass; third, shots loaded high in the barrel generally throw and spread the mass over a greater area of the quarry-floor, affording a greater opportunity for distribution and classifying. Again, this method offers greater safety by leaving the banks sheer, avoiding 'hang-ups.' The straight method also offers more advantages for hand-loading.

The particular field-conditions favorable to 'springing' may be outlined as follows: First, a saving is obtained in drilling expense, as the spacing of holes under this method is always much greater; second, heavy 'break backs' are encountered that could not be hoped for under the straight method; third, the excavated mass can be confined to a small area by simply lifting and dropping it, thereby avoiding the chance of scattering over a large area of quarry-floor. This method is especially applicable for economical handling with heavy steam-shovels, as it reduces expense in moving shovels and in shifting track. Again, heavy toes can be handled under this method by drilling below the quarry-floor; this is not possible under the straight method, which requires a sheer face. It is, however, practicable to maintain a sheer face if governed by proper spacing, and while many things can be said in favor of the method of 'springing' well-drill holes still this practice is largely recognized as an infringement on the 'coyote' method, and in fact by some authorities it is considered an improvement over that method from the standpoint of economy.

There are disadvantages is both systems, which may be summed up, as follows:

The straight system requires closer spacing, therefore, more expense in drilling, but in a large degree the powder costs under this method can be materially reduced.

'Straight' shooting requires practically a perpendic-



READING THE TEMPERATURE OF A HOLE 141 FT. DEEP

ular face for the best results, because one can employ only as much breaking-power in the bottom as along the entire length of the barrel.

Under ordinary working conditions, even though the well-known method of separating the charges in the barrel be employed for the purpose of avoiding overshooting the weak spots or regulating the fall, the mass cannot be successfully controlled in an effort to simply drop it into a small pit on the floor, and in such cases, where there is only a small space available for dropping the excavated mass, or where the tracks are liable to be covered on short levels, the straight system is usually at

a disadvantage. On the other hand the springing method no doubt carries with it three distinct disadvantages, namely; in hard formations the mass cannot be broken as well, chiefly because the charge is seated in a pocket, as when the 'coyote' method is employed, and does not come in contact with the mass in general; the banks cannot be maintained uniform on account of uneven 'overbreaks', which at times prove an inconvenience and added expense in maintaining the tracks on the levels that have been over-broken. This disadvantage, however, can be overcome to some degree by close attention on the part of expert powdermen; finally, the hazard connected with re-loading sprung holes is generally recognized by competent powdermen, and this question was given the larger amount of attention during this study. I would say unhesitatingly that springing and re-loading of well-drill holes should be entrusted to the care of expert men only, and then the work should be conducted always with caution to avoid accident. It should be remembered that the temperature of the rock in the hole after it has been sprung is an unknown factor. Repeated springing produces heat in the bottom of the hole in two ways, namely, the actual heat developed by the explosion is communicated to the side-walls of the hole, this representing one source of heat, and next, the heat stored up in the disintegrated rock, which had been at or near incandescence, and which will not readily part with its heat after the explosion, since a pulverized mass of rock is a highly non-conducting medium.

Again, tests made by springing mineral-bearing rock show the development of more heat than is present in ordinary rock. Another factor, which is always indefinite, is the temperature of the rock back from the surface of the sprung portion of the hole. After repeated springing, the rock may be heated to the extent of more than a foot from the exposed surfaces of the side-walls. After a time the surface of the rock will cool, facilitated by cleaning out, so that temporarily the wall is cooler than it will be at a later period after the still heated rock has had time to re-heat this outer zone even though some of the débris might have been blown or sludged out. The chance for a premature explosion would in this case be greatly enhanced if tamping had already commenced, thereby preventing the escape of accumulating gases.

During this study, a record of a well-drill hole 86 ft. deep, drilled in hard mineral-bearing rock, proved of great interest. Immediately after the drilling tools were removed, the following records were established with a recording thermometer:

	Temperature, deg. F.
Immediately after the tools were removed	92
10 minutes " " " " "	90
20 " " " " " "	90
30 " " " " " "	90
3 hours " " " " "	90

Therefore, 90° Fahrenheit was taken as the established normal temperature of the hole, and it was further assumed that the loss of two degrees from the first record was the result of the hole being slightly heated under the drilling process. The hole was then sprung with 42 lb. of 40% powder, four barrels of water-tamping being used, which raised the water to a height of about 7 ft. in the barrel. The springing-charge as usual threw most of the water out of the hole, leaving about 4 in. of water in a sump in the bottom of the 'spring'. The following recording-thermometer records were then established:

	Temperature, deg. F.
Immediately after first spring	96
10 minutes " " "	98
20 " " " "	100
30 " " " "	98
40 " " " "	94
50 " " " "	92
1 hour after first spring	92
1 hour 20 min. after first spring	90
1 hour 30 min. after first spring	90
5 hours after first spring	90

It is plain therefore that the temperature of this hole apparently started to increase, that this was maintained for 20 minutes after it was sprung, after which it commenced to recede and reached its normal 1 hr. 20 min. after the first spring. The rise in temperature after the first reading, no doubt can be accounted for by the temperature of the water holding it down, being scattered throughout the spring and along the sides of the barrel, but gradually the heat injected into the rock re-appeared on the side-walls, resulting in the warming of the water and the rise of temperature as shown. Now, reasoning from similar relationships, and as further substantiated by other experiments, it is safe to say that, had this charge been greater, it would have required a greater amount of time to reproduce the normal temperature of the hole.

Another case of record is worth mentioning; a hole 91 ft. deep had been drilled in a hard mineral-bearing rock and repeatedly sprung, 950 lb. of 40% powder being used in the last spring. On top of this, 27 ft. of solid tamping had been used in an effort to protect the barrel. Nine days after this hole was last sprung instructions were given for loading and shooting it. Finding that the solid tamping had not blown out, a drill was put over the hole which cleared it. A recording thermometer was then lowered, and the following temperatures were determined: Immediately after hole was cleared, 197° F.; the thermometer quickly receded, and within six hours after the hole was cleared, 94° F. was established, which was considered the normal temperature of the hole. Loading of the hole then proceeded. Had the recording thermometer in this case failed to serve as an alarm, an accident would have probably resulted, since the nine days that had elapsed since the springing of the hole would have made it appear safe. In this case, however, it was decided that the heat was retained in the hole by the tamping failing to blow, and was held as in a thermos bottle. Under these conditions, the loading of a 'sprung' hole should always be done with a proper understanding of all the factors involved, and when a hole has been repeatedly sprung for the purpose of producing a large chamber, proper conservatism should be exercised in determining what is a safe time after the last spring before attempting to load.

Some years ago I advanced the theory and recom-

mended the use of a recording thermometer as a means of determining the temperature in well-drill holes, and I find that the theory and practice were misunderstood, as I have been continually asked for information regarding the ignition-temperature of various explosives. The facts are that I have used the recording thermometer only as a guide to the temperature of the hole, as the results so obtained are relative only. It would be by chance only that a thermometer would be in contact with the hottest portion of the rock. In addition to this factor of error, it should be remembered that the rock may be much hotter back from the surface of the spring than it is in contact with the sides, since the side-walls are cooled to a considerable extent by air currents set in motion by the warmth of the sides, and thus the higher temperature a few inches back in the rock is only developed after the expiration of some time. Again, in holes that have been heavily sprung, it was found quite impossible to get a thermometer back against the side-walls of the spring, which no doubt was the hottest part of the hole, and while I highly recommend the use of a recording thermometer, it is only with the idea of establishing the normal temperature of the hole and of preventing the loading of explosives in any hole above its normal temperature.

In this connection it should be remembered that all commercial explosives are inflammable and will burn when they are sufficiently heated. If, for example, any of the commercial explosives are brought in contact with a piece of rock or other material, which has been heated to 300° or 400° C. they will at once be decomposed, and will either begin to burn or will detonate. Nitro-glycerine explosives usually detonate with violence when thus over-heated, especially if confined. Nitro-starch explosives will also detonate under these conditions if considerably confined, but under normal conditions nitro-starch explosives will usually burn quietly unless so confined in a hole as to make the escape of their combustion-gases difficult or improbable.

In determining the ignition temperature of any explosive, it is necessary to bear in mind the distinction between the actual temperature to which the material is heated and the time during which the material is kept at such a temperature. At a red heat, all explosives will burst into flame or will detonate practically instantaneously, while at a lower temperature an increasing amount of time is required before ignition or before explosion occurs. In all cases, the time-factor is important and should not be disregarded.

In thawing dynamite, it has sometimes been the practice to place frozen sticks in an inner can surrounded by an outer jacket of boiling water. Experience has shown that frequent accidents have occurred in this way when a stick of dynamite has been left in the thawing kettle for more than a few hours, and, while dynamite withstands heating to the temperature of boiling water, longer exposure at exactly the same temperature may bring about sudden detonation of the material. While Trojan explosives withstand considerable over-heating, yet prolonged exposure to too high a degree of heat will of course produce ignition. Since experience has shown that the hot sides of sprung-holes will, under certain conditions, retain their heat sufficiently long to cause difficulties where the powder comes in contact with such heated rock, tests have been made to determine the relation which exists between the temperature and the time of heating. These tests, made with standard grades of 40% Trojan explosives, were made under the most careful laboratory supervision, and show the temperature and the amount of time to be applied before ignition takes place.

Temperature, deg. F.	Min.	Sec.
401	6	8
392	9	2
383	11	2
374	19	1
365	31	6
356	53	4

These tests show in an interesting manner the relationship existing between the temperature and the time of ignition. Again, the relationship between the temperature and the time of heating becomes involved with the quantity of explosives under the test. With larger quantities of explosives, the relationship between the temperature and the time of heating becomes involved, through the introduction of a number of secondary factors, of which the principal is the retention by the sample of the heat, which is produced by the exothermic reaction occurring when an explosive is decomposed, and further proves that an explosive substance slowly decomposable at a certain temperature is able to exist at higher temperatures, though during a gradually shortening interval. Considering the fact that small samples of Trojan explosives fail to ignite when heated to temperatures between 302° and 347° F. under careful tests, it would be unwise to apply this rule in practice under ordinary loading conditions, as, under the tests, the ease with which the heat evolved by decomposition is lost, by no means would apply to large quantities of explosives seated in a charge and packed in a bore-hole. In order to ensure the highest degree of safety and to avoid the chance of accident, from the loading of sprung holes with any of the commercial explosives, I would say first that it is necessary to establish the normal temperature of the hole and to allow no explosives to be loaded in any hole above its normal temperature, as the product of all reliable manufacturers of explosives can be relied upon to resist such conditions with perfect safety.

Personally, I would have no fear of loading Trojan explosives under ordinary working-conditions in a hole the temperature of which was not in excess of 140° F., provided that the normal temperature of the same hole was not less, and, further, that the origin of the heat-factor was natural and definitely established. As all such hole temperatures are abnormal, the pre-determined or original temperature of the hole before it was sprung would be fully taken into account and reckoned with, for reasons of safety.

The highest temperature ever recorded by the U. S. Weather Bureau shows a maximum of 134° F. established

at the Greenland ranch in Death valley during the month of July 1913. While Trojan explosives under no conditions would ever decompose under such temperatures, and in fact resist temperatures beyond the boiling point, 212° F., for days, still it would be folly to assume the risk of loading explosives in a hole containing foreign heat of any character, for the reason that you are then dealing with the unknown, and that is one of the most dangerous elements connected with the operation of loading. Therefore, all abnormal hole-temperatures should be considered a danger-signal, regardless of their range, principally from the fact that they represent unknown factors, and, under ordinary working-conditions, their highest range, for reasons already outlined, cannot be definitely proved. From established records by thermometer covering 841 well-drill holes, extending from 36 to 141 ft. in depth, and 86 tunnels or 'coyote' holes, the highest normal hole-temperature ever encountered was 98° F., although these records were taken all over the United States and Panama, where intense heat prevailed, and for this reason I consider 98° F. a maximum normal hole-temperature. Even under such working-conditions as are found in the hottest part of the States, in order to ensure greater safety, any hole showing a higher temperature than this or any maximum established in the same way on any particular work, should be considered dangerous and loading should not proceed before the cause of the excess heat had been definitely determined.

I am thoroughly convinced that if these suggestions were to be put into practice, they would entirely obliterate all chance of accident from this source, and while an extended series of laboratory and field-tests have shown that Trojan explosives of all grades successfully resist heating in a satisfactory manner, and that ignition is difficult to produce by over-heating these explosives, the loading of explosives into holes that show abnormal temperatures or a high degree of rock-heat, is strongly to be condemned. It would represent a wholly unnecessary hazard from the factors of hidden rock-heat; and also from the effect of continued exposure of the explosives for long periods of time to relatively high temperatures. This becomes necessary where the hole is to be loaded with a heavy charge, which means a prolonged loading-period.

Care should always be exercised by well-drill foremen in closely watching and reporting to the powder-foremen any abnormal condition encountered during the drilling. In case the drill should break through into any old working, such facts should be made known to the powder-men. All holes should be covered by the drillers, and care should be exercised to prevent anything dropping into them that will either catch fire or retain heat. When a springing-charge is fired, heat is always liberated in the explosion, and as the amount of heat per unit-weight of explosive is an important factor governing its power, this feature cannot be avoided and must be reckoned with, as the springing-charge is liable to fire any inflammable material in the hole or to so impregnate any conductor of heat as to become highly dangerous to loading or to additional springing operations. It should also be remembered that the sensitiveness of most explosives increases as their temperature rises, and while nitro-starch explosives are not highly inclined to such behavior, an excessive or abnormal heat should be avoided in the handling of any explosive. For instance, as pointed out by many authorities, nitro-glycerine confined between steel plates requires, under the fall of a hammer, for detonation:

Temperature, deg. C.	Energy, Mkg.
16	0.2
94	0.1
182	slightest blow

This shows that only one-half the energy is required to detonate the nitro-glycerin at a temperature of 94° C. as is required to accomplish the same purpose at 16° C., and it further proves that high abnormal temperatures of explosives would tend to make detonation more easily possible by rocks or other substances being accidently dropped into the hole. In reality explosive reactions can be attributed to a preliminary heating that may be gradually transmitted, directly or indirectly, thus raising successively all the parts of the total volume of the substance to the temperature of decomposition. Shock, pressure, friction, or mechanical effects, in reality play their part in detonation by causing preliminary heating. Therefore, from this standpoint abnormal temperature should be guarded against, and, to ensure the highest factor of safety, it should be avoided entirely.

A LARGE PROPORTION of British-controlled mines in Canada have been unprofitable. However, there have been a few outstanding instances of large profits. Such an instance is that of the Mond Nickel Co. In 1906 it first commenced to pay dividends on the ordinary shares at the rate of 6%; but the profits increased so rapidly that seven years later the dividend rate on the ordinary shares was advanced to 35%, and the holders of the deferred shares received 158%. In the same year the capital was reconstituted, each £5 preference share being exchanged for five new shares of £1 each, for each ordinary £1 share a 7% preference and 1½ ordinary shares were given; and the £1 deferred shares were exchanged for nine ordinary shares. The capital at present consists of £1,880,000 in shares, £375,000 in 5% first-mortgage debenture stock, and £500,000 in 6% redeemable debenture stock. Of the share capital £500,000 is in 7% cumulative preference, £480,000 in 7% non-cumulative preference, and £900,000 in ordinary, the issues being of £1 par value in each case. From a modest beginning of a profit of £2095 in the second year of the original company's existence, there was an almost continuous increase to £300,296 in 1914-15, raised in the following year to £322,589, then to £327,248 in 1917, and to £531,846 in the past 12 months. Naturally the company could not have achieved these results if it had not possessed very valuable and extensive orebodies; but not the least of its assets has been and is the skill, efficiency, and brains of its management.—Canadian Mining Institute Bulletin, November 1918.

The Future of Dredging

By CHARLES JANIN

*The highest point of production for the gold-dredging industry in the United States has been reached, and during the next few years a marked falling off in gold production from dredging operations may be expected. The success attending the flotation of the larger dredging companies proved an incentive for explorations and examinations in various States, and all land thought attractive for dredging was soon taken. The problem of finding suitable ground for dredging is difficult, although with the great improvements made in dredging machinery and the resultant reduction in operating costs, it is obvious that gravel beyond the possibility of economic dredging under early conditions could now be profitably handled. This is shown by the operations of nearly all the large dredging companies whose available dredging ground has been greatly increased as working costs have been reduced.

A fact that also draws attention to areas once considered unprofitable is that the life of some of the successful dredging companies is drawing to a close; that is, the land for the working of which the companies were originally formed is being rapidly worked out. Several of these companies are realizing that their ground is nearly exhausted and that they have some dredges in good condition, fit for some years of operation. What is probably more important, they also realize that they have also well-organized working forces, valuable experience in dredging matters, money in the treasury, and the confidence of shareholders. Aside from such influences, there is no question that under favorable conditions areas that were once considered unsuitable for economic dredging can now, with improved methods, be profitably handled. The possibilities of reclamation of dredged land may prove important in estimating the profits to be won from dredging areas in California. The success attending the efforts of some experiments in this direction in a small way has greatly broadened the expectations for the future of what was, until recently, considered worthless land. A more liberal attitude on the part of the agriculturists and arrangements permitting the modification of some of the rulings of the Debris Commission in California would open to the dredging industry areas that are at present closed.

The possibility of re-dredging the tailing from the early dredges at Oroville, partly with the idea of reclaiming lands that would command a fair market, is occasionally discussed in the non-technical press. This proposal has not met with any enthusiasm among the conservative operators, but it should be realized that the greater improvements in the dredging industry are not due to the most conservative men; one must be optimistic to undertake new methods. Altogether it seems probable that dredging enterprises will continue in California for some years to come, although the amount of gold won from dredging operations in the State was at its peak in 1913. During 1915-'16 there have been a number of new dredges planned and at the time this is written there are nine new dredges either under construction or projected for the Californian fields alone. Four of these are 16-ft. boats, three 9-ft., and two are old dredges being moved to new locations. The writer pointed out in a paper read before the San Francisco meeting of the American Institute of Mining Engineers in California, 1911,† that dredges of even larger capacity than those now in use for gold dredges had been considered in the reclamation of dredged areas. The following extract from the paper is pertinent:

With the development of the gold dredge to its present efficiency, the question is often raised as to when the limit in size for economic dredge installation will be reached. Much depends upon the conditions met in operation. There is no question as to the mechanical possibility of larger buckets. In Boston harbor a bucket-elevator dredge equipped with buckets of 2 cubic-yard capacity has been successfully operating for some years on harbor work, and on the Danube river in Germany a bucket-elevator dredge having 2.5 cubic-yard buckets is now in operation. While the mechanical possibilities have thus been proved, to apply such radical changes in size to the gold dredge of today would necessitate an entirely different arrangement of the gold-saving tables and would probably result in a general modification of the whole gravel-washing apparatus now in use. Even the most optimistic advocates for increasing the size of the dredge buckets would hesitate at recommending a 2 cubic-yard bucket, which is nearly four times the present size of the buckets on the largest gold dredges in operation, but there are a number of engineers who believe that the bucket-elevator dredge with buckets having a capacity of 1 cubic yard will be constructed before long. While a dredge of this character would necessarily be equipped with heavier machinery and a larger hull than those on the present 15 cubic-foot boats, it is, as before stated, quite possible that, with modifications of the washing apparatus, the hull of the 1 cubic-foot dredge may not be proportionately larger. The present 15 cubic-foot boats have a hull 60 by 150 by 12.5 feet, with a deck overhang of 5 feet on either side, making a total width of 70 feet. The gold-saving tables are of the double-bank type and have an approximate area of 7000 to 8000 square feet. Without some change in the washing apparatus, it can readily be seen that 14,000 square feet of table area would necessitate a hull of greatly increased

*Excerpt from 'Gold Dredging in the United States', U. S. Bureau of Mines.

†Janin, Charles, 'Present-day problems in California gold-dredging': Trans. A. I. M. E., Vol. XLII, 1912, pp. 855-873.

size, or additional tiers of tables, for which an increased length of bucket ladder would be required to elevate the gravel to the additional height, or a general change in the design of the boat. Practice has demonstrated that when digging free-washing gravel the table area of the 15-foot boats is considerably in excess of all requirements, and some operators contend that it would not be necessary to proportionally increase the table area when buckets of 1 cubic-yard capacity are constructed.

There may be a field for dredges of this size, for instance, in the Oroville and Folsom fields, to re-dredge the tailing piles left from the first dredging operations. After many of the cobbles have been removed for the rock-crushing plants, the ground, if dredged, will, in many cases, yield a fair return. Especially would this be the case in the areas where the early dredges worked, as the gold-saving apparatus of the first successful dredges was not as efficient as that in present use.

In Alaska the success attending the operations of some of the dredges recently built there has greatly widened the field for the dredge-construction companies. Previously the demand has been for small dredges, especially on the Seward peninsula, but the successful operation of the large dredges of the Canadian Klondike Co. on the Yukon, and the Bonanza Creek operations of the Yukon Gold Co. have encouraged investigation of areas in other parts of the northern field. Unfortunately, many of the dredges built in Alaska have been constructed prior to adequate prospecting of the ground they were to work. Failure to sample a dredging property until the dredge has been built, when 'large practical samples' can be taken, is almost to invite loss. Although the dredge may prove a success mechanically, the company is generally doomed to economic disaster unless more favored with good luck than good judgment.

Besides the possibility of new dredging enterprises in California and Alaska, the attention of dredge operators is being attracted to areas in other Western States where the gold content has previously been considered too low. The difficulties surmounted in dredging operations in California, Montana, Colorado, and other fields, and the low working costs obtained in these fields and in Idaho, open possibilities unthought of a few years ago.

In addition to the possibilities in the United States and Alaska, considerable attention has been given to foreign districts. Chief among the countries being considered are Russia, including Siberia; South America, principally Colombia; and the Federated Malay States. The success attending the work of some Russian dredges and the purchase early in 1916 of three American dredges for Russia has stimulated inquiry into the possible openings for American capital in dredging projects in that part of the world. It is rumored that the Russian government has considered the advisability not only of taking off the high duty heretofore imposed on machinery for gold mining, but also of subsidizing to some extent gold-mining companies; such procedure would undoubtedly stimulate investigations of dredging areas in that country. In new enterprises in Russia or Siberia, it will be found advisable to have the assistance of influential Russians. It is held by engineers qualified to pass an opinion that in Russia and Siberia, so far as operating conditions are concerned, there are a number of areas of gravel that can be profitably dredged, and the examination of some of these fields may result in more dredges being erected in the near future. A pertinent point in this connection is that the Russian peasant in some localities makes a really first-class mechanic, so that it is not necessary for a foreign dredging company to import expensive laborers for all positions on a dredge. Conditions of operation in Russia and Siberia, aside from taxes and government regulations, are very similar to those in the Yukon and Alaska, and operating costs should, under ordinary conditions, be closely similar. The success made by the gas, oil, and wood engines in Alaska should encourage dredge installations in localities where electric power is not obtainable.

There are undoubtedly in Colombia and other South American countries areas that offer promising returns from dredging operations.

In the Philippines the success of the Guamos dredge has encouraged other operations and an American dredge built in 1914 for the Mambulao Dredging Co. embodies some striking innovations for generating power on board the dredge.

An American dredge was constructed for the Chiksan Mining Co. in Korea during the latter part of 1916. Its success will do much to encourage further dredge installation on the Orient. In Portugal a dredge built under plans of an American dredge-construction company for American capitalists is being operated in tin deposits, and its success has awakened interest in tin dredging. In 1915-'16, several orders for new dredges for the Malay peninsula were placed with American dredge-construction companies, and this region offers considerable promise to the wide-awake constructor.

Although there is room for considerable improvement in the gold-dredge, the wasteful and inefficient methods usually employed on tin-dredges should give our dredge-construction engineers a splendid opportunity for increasing the recovery. The profits made by some of the tin-dredges have been large, and doubtless no necessity has yet been felt for inquiring closely into methods for decreasing the loss in the dredge tailing. It is when low-grade material is handled that metallurgical methods are improved. It is probable that American operators will be offered more or less attractive opportunities to participate in some of these tin-dredging projects in the near future.

In making investments in dredging enterprises in foreign countries, as elsewhere, much money may be saved if prospective investors will insist on having reports by experienced engineers. With the drawbacks of operating in foreign countries, together with unusual government regulations, and other disadvantages incident to dredge work away from home, possible dredging areas in the United States, though of lower grade than some that are being at present worked, and of much lower gold content than is necessary for profitable operation in foreign countries, will probably be more attractive to conservative investors than the foreign fields.

Differential Flotation of Lead and Zinc Sulphides

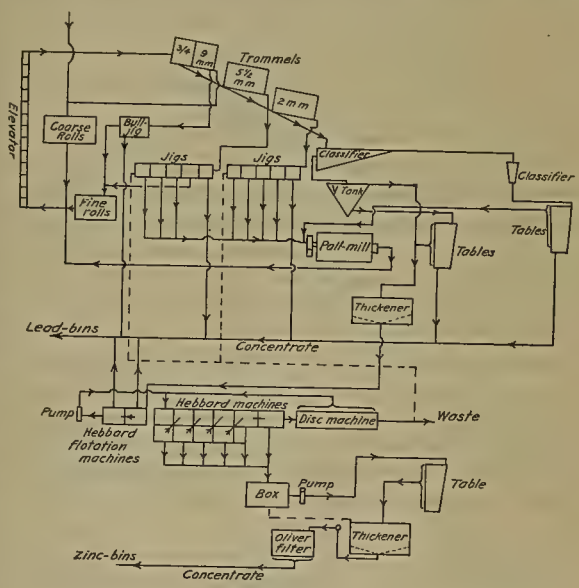
By ALGERNON DEL MAR

In oil concentration, no matter what oil or reagent is used, lead will always float more readily than zinc. Salts of chromium will deaden lead in preference to zinc, but experimentally I have always found the lead to float first. In the treatment of a lead-zinc ore there may be further differential concentration in separating iron sulphides from the lead or zinc. Copper sulphate will facilitate this separation; the same forces come into play, that is, the ease or difficulty with which the surfaces are wetted.

When the case is further complicated by a high silver content, the differential flotation of lead from zinc becomes more important, for it must be the aim of the metallurgist to throw as much of the silver, whether associated with the lead or not, into the lead concentrate as possible, since the smelters pay for the silver in the lead and its recovery from the zinc is unsatisfactory. The natural tendency in differential flotation is for the silver sulphides to rise with the lead in the froth, that is, if the conditions are such that the lead will rise in preference to the zinc, the silver will be found with the lead except where it is intimately associated with the zinc.

As a result of the ease with which lead is lifted in any flotation system, as compared with the zinc, the separation of the lead must precede that of the zinc. My experience indicates that a thicker pulp is advantageous for differential flotation of the lead. To float lead successfully the content in solids should be over 25%. In zinc flotation that is not so important, nevertheless better work is obtained in both cases with a thick pulp. I should place the limits for lead at 25 to 30% solid, and for zinc at 20 to 25% solid. It is important that in both cases the moisture content should be kept constant, any variation in this respect requiring an adjustment in the other factors. As all flotation machines are fed from a thickener of some sort the stream of pulp should be of constant thickness, whether the crushing end of the mill is at work or not. The usual plan is to vary the size of the spigot on the discharge of the thickener or to vary the speed of the pump connected with the thickener. For the successful separation of the lead sulphide from zinc blende, the volume of air, its pressure, or the speed of rotation of the agitating paddles or drums, should be less when frothing lead than when frothing zinc. For example, using an M. S. machine, the speed of the propeller shaft in successful lead flotation need not be over 200 r.p.m., but to raise zinc this speed must be increased to at least 600 r.p.m. At the latter speed, with the mixed sulphides, too much zinc would come up with the lead.

Another consequence of the tendency of lead to float first is that the quantity of reagent used in lead flotation must be that which is just sufficient to raise the lead, without any excess. Also the reagent need not be emulsified or pre-mixed, but may enter the agitating cells with the pulp. In raising zinc the oils or reagents should be thoroughly mixed with the mineral pulp before going to the flotation cells, either by agitating in a centrifugal pump or in a mixing tank. A fine spray of oil is preferable to oil in bulk. The selection of the reagent is perhaps less important if the conditions already specified are attended to properly, but better results are obtained with certain oils by reason of their different viscosities, their sensitiveness to emulsification, or their natural tendency to wet some sulphides in preference to others. I have placed this factor last as, in my opinion, it is the least important. Broadly speaking the manipulation is more important than the reagent. I could name several oils that, under the right conditions of manipulation, will give equally good results, but some are more difficult to handle. For example, many pine-tar oils that are too thick for use where the mill-water is ice cold would give good results with warm water. Again, tar, when used for silver-lead flotation, gave good results, but on touching the cold water the tar thickened into stringy masses which clogged the pipes entering the flotation cells. I do not say that I believe one oil or reagent to be as good as another, but without proper manipulation no oil will give good results. I have found that an acid pulp is



FLOW-SHEET FOR MIXED GRAVITY AND FLOTATION TREATMENT

better for raising lead than zinc, and that a neutral or alkaline pulp is better for zinc than an acid pulp; also that a pulp rendered alkaline with soda is better than one made so with lime. This no doubt is due to the simple dehydration of the gel compounds caused by soda in contradiction to the flocculent condition produced by lime. While lime may be added to a thickener to settle the concentrate for filtration it is not beneficial if added in a thickener for flotation, although by its use a clearer overflow may be obtained. As manipulation is all important we see why the application of oil flotation to concentration fails when attention is given solely to the reagent and not to the conditions pertaining to the treatment of the pulp. The soda should be added in the form of a solid, not as a liquid. Better results are obtained this way.

Under manipulation may be included the shape or form of the collecting-chamber of the flotation machine, for the cells in any flotation system are used for two purposes, either to float a dirty concentrate, which must be cleaned before marketing, or to float a finished concentrate, which is ready for shipment. In the former case the collecting chamber of the machine should favor a quick discharge, that is, there should be a narrow chamber, but when we require a finished product the box must be sufficiently wide to allow the settlement of occluded waste or gangue. Manufacturers of flotation machines miss this point and therefore the same machine is often used for roughing and for cleaning, while the two operations require entirely different manipulation. This important structural feature in the flotation-chamber may make the difference between success and failure, for not only must a concentrate be produced, but it must attain a certain grade of metallic content to be fit for shipment. Should a concentrate be produced that is not up to the requirements for economic marketing a further concentration must be made, either in another flotation-cell or by water-concentration on tables. It is then probable that, in any scheme of flotation treatment, water-concentration may be required, with a return of the tailing to the flotation-cells. This may give encouragement to some operators who have thought the beginning and the end lay in oil concentration, without considering the use of water concentration either before or after, or both before and after, oil-flotation.

This naturally brings up the question of flow-sheets. The lead-flotation pulp may be concentrated by two different flow-systems, either by taking off the lead concentrate from two M. S. cells as clean concentrate, or by using the first cell as a rougher, and cleaning in the second cell. The second system has its advantages, but sometimes does not produce a better product than the first system. As to the zinc, the secret of low tailing with high-grade concentrate is due to the great amount of rougher-zinc slopped over the rougher-cells, and to the wide collector-box on the cleaner-cells. In my experience the rougher was worked to the full capacity of the cleaner-cells. The cleaner-cells preceded the rougher-cells, and the flotation-oils and soda were added to both the cleaner and the rougher-cells. The quantity of reagents added was a portion of the manipulation which would indicate little without taking into account the character of the ore and the grade of the feed. For the benefit of those who see a loop-hole in the 'over one-half per cent of oil' I may state that my experience leads me to believe that a non-frothing oil helps to kill a portion of the frothing-oil if the former is used in excess, that is to say, at times it may be useful instead of reducing the amount of frothing-oil to increase the amount of collecting-oil.

As regards the different reagents for the separation of galena from blende, and then concentrating the remaining zinc, in the order of their usefulness for separating the lead I place eucalyptus oil first, particularly with an acid pulp; next cresylic acid; then hardwood creosote; and lastly pine-tar oils. Eucalyptus oil can always be depended upon to give about the same results, but that is not so with cresylic acid. The cresylic acid issued by some manufacturers is of little account, so one must be careful in the selection of this reagent. By good manipulation creosote can be made to give as good results as other reagents so far as lead separation is concerned, but is not so good for raising silver sulphides. The amount of reagent for raising lead varied but little per ton of pulp from day to day, and may be taken to average about 0.07 lb. of eucalyptus oil, 0.40 lb. cresylic, and 0.40 lb. creosote per ton of pulp. Eucalyptus oil costs at least three times as much as cresylic acid, but not one-fourth as much is necessary to obtain the same or better results. It is a more sensitive reagent than cresylic acid, and must be used judiciously, for the difference of one drop per minute makes a great difference in results. The addition of crude carbolic acid to the cresylic acid made an improvement when the cresylic acid was of poor grade, but the addition of soda to either the eucalyptus oil, cresylic acid, creosote, or pine-tar oils, did not improve the lead product.

The following figures will indicate what was considered good work. With a flotation feed containing 3.6% lead, and 23.3% zinc, a lead product containing 60.8% lead and 23% zinc was obtained with cresylic acid. The best results in floating zinc were with Cleveland Cliffs No. 2 creosote and water-gas tar in the cleaner-cells and Pensacola 350 and water-gas tar in the rougher-cells. There is a great difference in the water-gas tar produced, and care must be taken in the selection of this product. While crude oil and other petroleum products answer for collectors the best results generally are obtained with water-gas tar made at St. Louis. With good manipulation and steady-running conditions, with heading assaying 3.0% lead and 23% zinc, the tailing in our mill would assay a trace in lead and 0.5% zinc. Due to faults in construction, which entailed unsteady running, the average tailing was more nearly 0.2% lead and 2% zinc. As to the silver, with flotation heading assaying 25 oz. per ton, the flotation-lead averaged over 200 oz. per ton, the flotation-zinc about 50 oz. per ton, and the tailing 2 oz. per ton.

The ore under treatment was a high-grade silver-lead-zinc ore, in which a part of the silver was intimately associated with both the lead and the zinc sulphides, and

part with gray copper. The lead and zinc were also intimately associated, which, on the whole, made the differential flotation a difficult problem. In fact, but for the feasibility of separating some of the silver from the zinc, and holding it with the lead, it is doubtful if, in this case, differential flotation was a success. The flotation heading was the tailing from water-concentration, using jigs and tables, and the flotation-zinc was re-tabled to extract what lead was possible. The lead-flotation concentrate was not re-tabled, for it was found that fine lead sulphide would float into the tailing under any condition of water-concentration. From the above observations and results we may decide that, technically, differential flotation was not much of a success, but, from a commercial viewpoint, it was eminently successful as the silver followed the lead instead of the zinc, and while the flotation-lead carried enough zinc to cause an extra smelter-penalty on the lead concentrate, the gain in silver more than offset this disadvantage.

The Rights of a Stockholder

To Examine Books of a Mining Corporation, Also to Visit Mine

[The following information was compiled in reply to a question from one of our readers. It may prove interesting to others.—Editor.]

588. Books and Balance-Sheets to be Kept by Secretary. Stockholders' Right to Inspect. It is the duty of the secretary of every corporation formed for the purpose of mining, or conducting mining in California, whether such corporation be formed and organized under the laws of the State of California or of any other State, Territory, or foreign country, to keep at some place within the State of California an office and in such office to keep a complete set of books showing all receipts and expenditures of such corporation, the sources of such receipts, and the objects of such expenditures, and also all transfers of stock. All books and papers must, at all times during business hours, be open to the inspection of any stockholder. He is entitled to be accompanied by an expert, and to make copies or extracts from any such books or papers. He may at reasonable hours, examine such mining property, accompanied by an expert, take samples, and make such other examination as he may deem necessary. . . . . All accounts, reports, and correspondence from the superintendent must be kept in some conspicuous place in the office of said company, open to the inspection of all stockholders.

589. Right of Stockholders to Visit Mine with Expert. Any stockholder of a corporation formed under the laws of this State for the purpose of mining, is entitled to visit, accompanied by his expert, and examine the mine or mines owned by such corporation, and every part thereof, at any time he may see fit; and when such stockholder applies to the president of such corporation, he must immediately cause the secretary thereof to issue and deliver to such applicant an order, under the seal of the corporation, directed to the superintendent, commanding him to show and exhibit such parts of said mine or mines as the party named in said order may desire to visit and examine. It is the duty of the superintendent, on receiving such order, to furnish such stockholder every facility for making a full and complete inspection of said mine or mines, and of the workings therein, and to accompany said stockholder either in person, or to furnish some person familiar with said mine or mines to accompany him in his visit to and through such mine or mines, and every part thereof. If the superintendent fails to obey such order, such stockholder is entitled to recover, in any court of competent jurisdiction, against the corporation, the sum of one thousand dollars and traveling expenses to and from the mine, as liquidated damages, together with costs of suit. In case of such refusal, it is the duty of the directors of the corporation forthwith to remove the officer so refusing, and thereafter he must not be employed directly or indirectly by the corporation, nor must any salary be paid to him.

590. Liability of Presidents and Directors. In case of the refusal or neglect of the president to cause to be issued by the secretary the order mentioned in section five hundred and eighty-nine, such stockholder is entitled to recover against said president the sum of one thousand dollars and costs, as provided in the last section. If the directors fail to have the reports and accounts current made and posted as provided in section five hundred and eighty-eight, they are liable, either severally or jointly, to an action by any stockholder complaining thereof, and on proof of such refusal or failure, he may recover judgment for actual damages sustained by him, with costs of suit. Each of such defaulting directors is also liable to removal for such neglect.

In the case of Hobbs v. Davis, 168 Cal. 556, it was held that a stockholder in a mining corporation is entitled to inspect the mining property of the company, and that this includes the right to be accompanied by an expert.

Similarly in the case of Hobbs v. Tom Reed Gold Mining Co., 164 Cal. 497, which was a proceeding by mandamus against a foreign mining corporation whose principal place of business was in the State of California, to enforce a stockholder's right of visitation, the court held that, under Sec. 589 Cal. Civil Code, a stockholder of a mining corporation has the right to visit and inspect the mine of the company, and that this was also true at common law.

To the same effect is Symmes v. Sierra Nevada Mining Co., 171 Cal. 427.

No licenses for the importation of amorphous graphite (plumbago) shall be issued hereafter, except such shipments as are of Canadian origin, and come overland or by lake from Canada, or of Mexican origin and come overland from Mexico. Licenses may be issued for the importation of graphite of crucible grade, when the applications therefor are otherwise in order.

High Temperature of Broken Ore

A square-set rill-stope on No. 3 level of the Bawdwin mine, of the Burma Mines, had reached the third stage. The second slice had been stoped out, and filling from the surface had been introduced through the waste-chute, until it had its natural slope of about 35°. Green lagging was then placed on the slope. Breaking had been in progress about three weeks when the stope commenced to get warm. Little attention was paid to the warming at first, as it was nothing unusual. Before long, however, it commenced to get uncomfortable for efficient work. Two days later the stope was unbearably hot, and the coolies could not work. That night the shift-boss telephoned that steam was coming out of the broken ore along the hanging wall, and he thought the timber in the stope below was on fire.

A thorough investigation took place at once. No gases could be detected, but the walls of the stope and the broken ore were hot. On scraping a couple of feet off the top of the broken ore, volumes of vapor would arise, caused by the humid tropical night-air coming in contact with the hot ore, which consists mainly of sulphides of lead and zinc. As no gases were detected, the phenomenon was immediately attributed to oxidation, and work was started to withdraw the hot broken ore. Water was also played on the ore, and on the coolies also, as the ore three feet below the original surface was too hot for their bare feet. In about 24 hours all the broken ore had been withdrawn down to the board floor resting on the fill. The following day the workings were cool.

At the upper end of the rill the ore was not over 8 ft. deep and at the bottom two or three feet deep. The longest time that any portion of it could have been in the stope would be four weeks, and this would be some of the fine that stuck to the green lagging on the floor at the top end and did not roll down the slope. At the end where the broken ore was thickest and hottest, the temperature was about 150°F. The ore below the surface had lost its bright lustre and was broken up quite fine, but other evidence of oxidation was possibly removed by the water that was thrown on it. However, the remaining ore on the hanging wall of the stope, adjacent to the broken ore, showed marked signs of rapid oxidation, especially of the zinc sulphide. The hanging wall also was coated with cobalt bloom, or erythrite, possibly the result of the following reaction:

$$\left.\begin{matrix}\text{Cobaltite, } CoAsS \\ \text{Smaltite, } (CoNi)As_2\end{matrix}\right\} + O = \underbrace{Co_3(AsO_4)8H_2O}_{\text{Erythrite}}$$

The average analyses of 19 stope-samples, taken during the actual breaking of the entire slice, and of seven grab-samples of the hot broken ore that remained in the stope at the time are as follows:

	Ag	Pb	Zn	Cu	SiO_2	Fe	CaO	Al_2O_3	S	Insol.
	Oz.	%	%	%	%	%	%	%	%	%
Stope sample...	42.8	42.2	24.4	0.4	5.4	3.5	1.5	0.7	21.3	...
Hot broken ore.	41.9	40.7	23.2	0.63	7.2	3.5	1.3	1.01	20.7	0.82

On comparison of the two averages, and on the calculation of sulphur contents in the broken ore, as required by the metals combined with the sulphur in the form of galena, zinc-blende, chalcopyrite, and pyrite, there is no appreciable decrease in the sulphur contents by oxidation.

In other stopes we have never had a similar occurrence, although we have noticed that the more broken ore in the stope, the warmer the stope. But in the past the increase in temperature had been attributed to less available air-space, as well as to slight oxidation. The ore breaks in large and small lumps in the majority of the stopes, which allows a more or less free circulation of cool air throughout the broken ore. But in this particular stope, the ore was more granular and broke very fine, giving more surface for oxidation and confining the heat, which accelerated the action. No complete chemical analysis has been made to determine the presence of any element that could act as a catalyzing agent and assist or cause such rapid oxidation, although cobalt, nickel, and arsenic are known to be present in very small quantities. The cause of such rapid oxidation is probably due to a combination of certain physical and chemical properties of the ore, all of which in this particular case happened to be present at the same time, for example: (1) the fine physical state of the broken ore; (2) the correct amount of moisture in ore and air; (3) the presence of (a) pyrite or marcasite, (b) some unknown catalyzer, (c) easily oxidized secondary sulphides and other sulphides at present unknown.

Any information from other engineers helping to explain this heating would be of great interest, not only to those in control of the mines, but to all mining engineers associated with sulphide-ore mines.—Allan B. Colquhoun, Mine Superintendent, in 'The Mining Magazine' for October 1918.

Silver Currency in China

The use of silver as currency in China began in the Sung dynasty (A. D. 960–1126), but it was made in the form of a sycee shoe, not as a coin, a practice maintained even during the later part of the Tsing dynasty (249–210 B. C.) A sycee shoe is calculated according to weight, regardless of the number of pieces, and there was no legal ratio between the tael and the cash. There are different sycee values owing to the difference in fineness, causing great confusion. For instance, there are seven different kinds of tael in Peking, and six different kinds of tael in Shanghai. Some taels, like the Shanghai, are fictitious. No Shanghai tael sycee is ever minted, but is merely used for calculations. Since the introduction of the silver coin, the use of the tael has greatly decreased. (The Kuping tael is regarded as universal because the Tsing dynasty used it in Government transactions). Since the founding of the Republic, public funds are received and disbursed in dollars (equal to Mexican pesos), not taels; but some interior places still use the tael, and even traders in Shanghai use it. It would perhaps be surprising to learn that there are no less than 65 different kinds of silver tael in China!

*Abstract from 'Far Eastern Review', September 1918.

Automatic Separation of Solution From Solids in Ore-Pulp

By BERNARD MacDONALD

*In the Parral counter-current system, agitation is effected in tanks by a number of air-lifts of comparatively small diameter through which the pulp is continuously transferred from the bottom of the tank and spouted horizontally on top of the charge. The force of the several streams thus discharged maintains a rotary flow in the charge of pulp, extending from top to bottom in the tank. This continuous transfer of pulp and the spiral flow from top to bottom maintains the constituents of the pulp in uniform proportions. The quantity of compressed air is small, as the pulp is not lifted but is simply transferred from the bottom to the top of the charge in the tank under hydrostatic balance. To further illustrate the apparatus which I use, and the explanation of the results obtained, Fig. 2, 3, 4, and 5 are submitted. These figures represent two views each of two adjoining tanks taken from the middle of any series of tanks in which the continuous treatment of pulp is being conducted. Fig. 2 and 3 show a vertical cross-section through the centre of two tanks equipped with my apparatus, along line *AA* in Fig. 4 and 5 which represent the top view of the same two tanks.

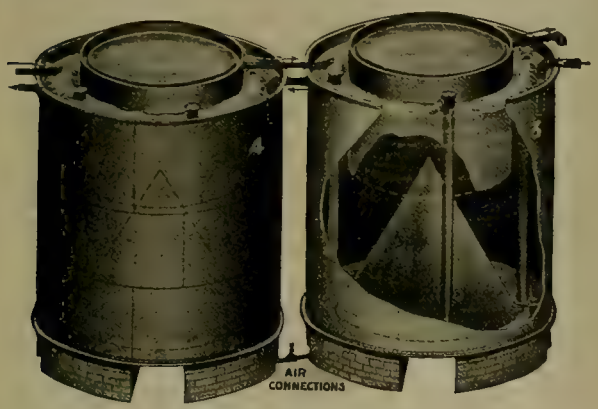


FIG. 1. COUNTER MIGRATIONS

PULP ——————→

←—————— SOLUTION

As shown in the figures, a diaphragm *C* is mounted concentrically in the upper portion of the tanks. This diaphragm is cylindrical in shape, open at the top and bottom, and is of such width and depth as required by the function it is to perform. The pulp is continuously agitated in the annular space between the diaphragm and the sides of the tank by transfer-pipes to which compressed air is conveyed through pipes *f*. At the bottom and below the lower edge of the diaphragm is the separation zone where the solids in the pulp settle by gravity and fall on the sloping sides of the zone *b* over which they gravitate to the intake ends of the transfer-pipes through which they are continuously transferred and spouted on the top of the tank-charge in the agitation circle. Above the separating-zone, the water or solution rises clear within the diaphragm, and by the hydrostatic pressure of the pulp undergoing agitation the clear solution is raised to a height above the level of the pulp commensurate with the depth of the sides of the diaphragm.

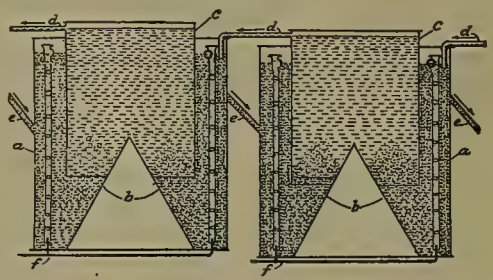


FIG. 2. FIG. 3.

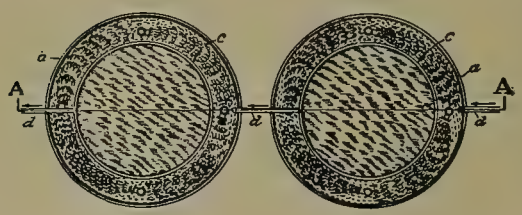


FIG. 4. FIG. 5.

As an example, if the pulp being agitated contains two parts by weight of solution to one part by weight of solids, it would have a specific gravity of, say, 1.26 (depending on the specific gravity of the solids) or, about one and one-quarter times the weight of the same volume of water. Therefore, if the sides of the diaphragm extend, for example, 9 or 10 ft. down into the pulp, the weight of the pulp would raise and balance a column of clear solution within the diaphragm to a height of more than 2 ft. above the level of the pulp in the agitation-circle. The separation of the solution from the solids takes place rapidly in the separating-zone at the foot of the diaphragm, probably due, in a considerable degree, to the centrifugal force set up by the rotary flow of the pulp in the agitating-circle. At any rate, clear solution

*Abstract Trans. American Institute of Mining Engineers.

separates from the pulp in this region and rises rapidly and continuously within the diaphragm from the top of which it is taken off through pipes *d* and delivered into the pulp being agitated in the next adjoining tank, and so on until, from the head tank of the series, the solution goes to the clarifiers to remove any fine slime that may be carried over in suspension, and thence to precipitation. The series of tanks in which the treatment is conducted is set so that each tank from first to last of the series is 6 in. below the level of the tank preceding it. This height is quite sufficient to overcome the friction from the flow of the pulp as it goes from tank to tank through pipes *e*. The last two tanks of the series may be specially arranged so that the pulp may be thickened to a high density before it is discharged to a filter-press or to the dump as conditions require. In this way, the counter-migration of the solids and solution is brought about automatically and continuously through any number of tanks equipped as shown in the illustrations. The precipitated cyanide solution which is added to the last tank of the series flows from tank to tank toward the head of the series, dissolving the metals from the solids with which it is agitated. The solution thus becomes enriched as it goes from tank to tank until it flows from the first tank for precipitation, while the solids being carried from the first to the last tank of the series become poorer until they are discharged barren from the last tank.

The same principle may be used in the acid-leaching of copper ores, but the tanks and the transfer pipes used for this purpose are made of wood in order to be acid-proof. This method obviates the use of pumps between the tanks, which give great trouble in handling acid solutions. The agitation of the pulp may be carried on within the diaphragm, leaving the annular space outside the diaphragm for the rise of the clear solution. I have designed this latter method for a plant having Pachuca tanks, but the first described method may be also installed in Pachuca tanks to advantage because the clear solution may be lifted to any height, allowing a series of tanks set on a level to be operated without pumps.

CHLORINE PROCESS IN MINTING GOLD. The Royal Mint at Ottawa, Canada, uses the Miller process for refining gold. The equipment consists of cylinders holding liquid chlorine so controlled as to give a gas-pressure of 5 to 6 lb. per sq. in., also oil-burning melting-furnaces, condensing-chambers at the rear of the furnaces and suitable pots, tongs, and molds. The gold and borax are melted in clay pots and the chlorine gas is introduced. Chlorides of gold, copper, and lead form a float on top of the liquid gold and are skimmed off. The gold ingots obtained are melted in a tilting furnace and cast in bars of 500 oz. This gold is tough and assays 995. By using the bars as anodes the fineness can be raised to 997.5 to 999.9 by the Wohlwill process. The combination of the Miller and the Wohlwill processes has the following advantages over the all-electrolytic process: (1) The loss of interest on large sums locked up during refining operations is greatly reduced, (2) the electrolyte does not become foul, as base metal is removed, (3) by using the finer anodes from the Miller process the formation of slime is reduced and any traces of platinum are recoverable from the electrolyte. The recovery of silver from the AgCl formed during chlorination is easier than its recovery from slime. The gold held by the AgCl is recovered by melting the chloride in plumbago crucibles kept at a temperature slightly above the melting-point of silver and 'salting out' the gold with sodium carbonate. After freeing the silver chloride from the gold, the fused cake is boiled in water by steam in a tank containing iron plates, the leached $CuCl_2$ being reduced to metallic copper by the iron. When free from copper, the AgCl cakes are reduced to metallic silver, washed, melted, and cast into bars. The silver produced is 999 fine and over. —R. Pearson in 'Canadian Chemical Journal.'

Iron Ore and Pig-Iron

Statistics compiled under the direction of E. F. Burchard, of the U. S. Geological Survey, show that the iron ore mined in the United States in 1917 reached a total of 75,288,851 gross tons, and exceeded the former record output of 1916 by 121,179 tons. The shipments from the mines in 1917 were 75,573,181 tons, valued at $238,260,333, a decrease in quantity of 2,297,372 tons, or 2.95%, and an increase in value of $56,358,056, or 30.98%, compared with shipments in 1916.

Iron ore was mined in 25 States in 1917 and 24 in 1916. California, Montana, and Nevada produced iron ore for metallurgic flux only; part of the output of Colorado, New Mexico, and Utah was used for smelter flux and part for pig-iron and ferro-alloys; the remaining States produced iron ore mainly for use in blast-furnaces, except small quantities used for paint from Michigan, New York, Wisconsin, and Georgia. The ore output of Minnesota, Michigan, and Alabama, the States that have for many years produced the largest quantities of iron ore, was respectively 44,595,232 tons, 17,868,601 tons, and 7,037,707 tons and was close to that of 1916, Minnesota having shown an increase of 0.02%, Michigan a decrease of 1.1%, and Alabama an increase of 4.3%. More than 1,000,000 tons of ore each was produced also by New York and Wisconsin in 1917. The Lake Superior district mined 85% of the total.

The quantity of pig-iron, exclusive of ferro-alloys, shipped or used by the producers in 1917, according to reports to the U. S. Geological Survey, amounted to 38,612,546 tons, valued at $1,053,785,975, compared with 39,126,324 tons, valued at $663,478,118 in 1916, a decrease of 1.32% in quantity and an increase of 59% in value. The average price per ton at furnaces in 1917, as reported to the Survey, was $27.29, compared with $16.96 in 1916, an increase of 61%. The production of pig-iron, including ferro-alloys, was 38,647,397 tons in 1917, compared with 39,434,797 gross tons in 1916, a decrease of 4.5%, according to figures published by the American Iron and Steel Institute, March 18, 1918.

LEADVILLE, COLORADO

General Review of Present Conditions in the District.

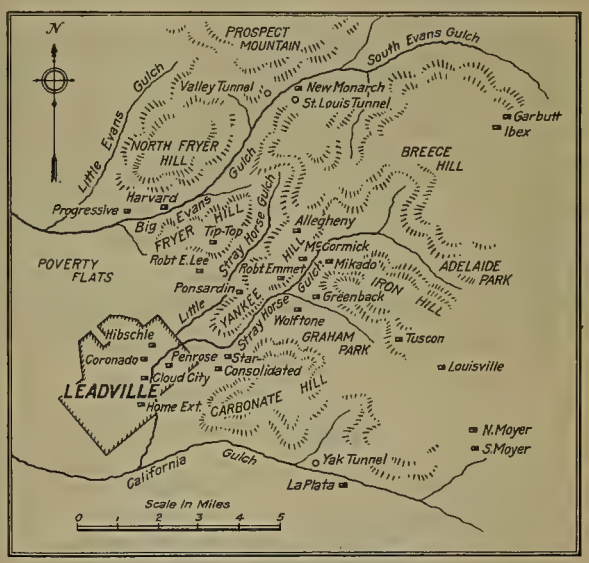
Compared with the great activity so noticeable a year ago, and the prospects for enlarged operations then in view, development in the mines of the Leadville district is now being conducted on a small scale. Two factors are mainly responsible for the present slump; the exhaustion of orebodies in a number of large properties and the shortage of labor. Under the first heading appears the closing down of three of the largest properties in the district. The Leadville Unit of the U. S. S. R. & E. Co., which had unwatered the Fryer Hill basin and carried on extensive operations through the Harvard, Jamie Lee, Tip Top, and Denver City shafts, stopped work in August, removed all of its equipment, including a fine electric pumping-plant at the Harvard, and allowed this large area to be flooded. The passing of the 'Unit' was the heaviest blow Leadville has experienced in years. It not only ended the operations of a strong and progressive company here, but it also knocked the bottom from the brightest dream among Leadville's good prospects —the dream of discovering a second contact in Fryer hill. Through all the years since the wonderful carbonate discoveries at the Matchless, Robert E. Lee, Little Pittsburg, and other famous Fryer Hill mines, Leadville had cherished the dream of another great boom when the Fryer Hill basin would be unwatered and the huge bodies of lead-silver sulphides 'known' to exist below the carbonate deposits would be opened to development. The dream apparently was about to be realized in February 1916, when the U. S. S. R. & E. Co. began work at the Harvard. Model mining equipment was quickly assembled. The shaft was drained and sinking started. Then the Jamie Lee shaft was equipped and several hundred feet added to its depth. It was not until this work had failed to cut ore or indications of ore in the lower horizon that Leadville began to despair of the undertaking; and when thousands of feet of drilling and driving proved equally unsuccessful, the hope of another Fryer Hill was reluctantly abandoned. The 'Unit' uncovered and produced a good deal of ore, but it was all encountered in the upper horizon where early-day development had been so successful. Nothing but lead porphyry and lime was encountered below, where in all the development completed not a trace of mineral was found. The company exhausted all the available orebodies in July, and by the first of August had abandoned its workings, putting nearly 100 men out of employment and leaving a barren area where it was believed the richest ground in the district would be found.

Earlier in the year, the Iron Silver Mining Co. announced that the Moyer properties, among the oldest and most productive mines in the district, were worked out and would be closed down. Shortly afterward, the company also abandoned the old Tucson mine on Iron hill, another heavy producer for 20 continuous years.

Other properties became inactive during the summer and fall. The Star Consolidated Mining Co., one of the largest producers of manganese in the State, greatly reduced operations because the market for its ore was cut off. The product was largely low grade and was being shipped to the Colorado Fuel & Iron Co. Milling difficulties caused the Mt. Champion to close, thereby stopping development in a new and promising section; and several smaller properties found it impossible to continue.

The labor shortage, while not responsible for the closing of any mine, has made it necessary for many companies to operate on a reduced basis. With influenza and pneumonia raging, conditions are steadily growing worse, and at several mines where two or three shifts have been working are now operating with one shift. It is estimated that there are 300 cases of influenza in Lake county and to date there have been 122 deaths.

Effective October 16, wages in the district were raised 50c. per day at all mines, making the minimum basis $4.50.



SKETCH OF LEADVILLE DISTRICT.

This action was taken by the operators in view of the growing scarcity of men and the impossibility of keeping a full force. Petitions circulated by the miners asking for an increase prompted the action.

To offset in some degree the loss of the recently-abandoned mines, a number of companies are making an effort to expand. The Down Town Mines Co., which successfully unwatered the Down Town basin through the Penrose shaft, and for the past year has been extracting a large tonnage of ore from the drained area, is preparing to re-open the Coronado shaft. Extensive deposits of lead, silver, copper, and manganese ores have been opened, making it possible for the company to maintain an output of 250 tons daily. The largest deposits of lead were encountered in the Otisito property at points near the Coronado shaft, and this old shaft is being put into shape for hoisting. A small electric plant has been erected for re-timbering the shaft, and will be replaced by heavier machinery when all preliminary work is completed. The Down Town company has developed its

holdings into one of the most substantial and promising enterprises in the district.

The Iron Silver Mining Co., after abandoning the Moyer and Tucson, is re-opening the Pyrenees shaft in Graham park, which will be operated in conjunction with the Mikado, the present operating centre of the company. The Pyrenees has been re-timbered and the large electric plant from the Tucson re-erected there.

The Greenback, under the management of the Western Chemical Co. of Denver, is being equipped for extensive development. New pumping and compressing machinery has been put in, and many improvements made to the hoisting equipment. Immense deposits of iron pyrite have been uncovered and a heavy output is being shipped.

The Yak Mines company has just completed unwatering the drowned Cord winze area, and is preparing to undertake new development work. Pumping equipment is being installed at the White Cap, where unwatering will be started shortly.

Among the smaller companies there is not a notable increase in activity. The C. J. Dold Mining Co., operating the Northern shaft, is branching out and will shortly re-open the Newell shaft for hoisting. Large bodies of manganese are blocked out, which is being shipped at the rate of 50 tons daily. This output will be doubled after the Newell becomes active.

The Doty Manganese Co., a new enterprise financed by Leadville people, is sinking a new shaft—the McDonald—on the S. Small property adjoining the Jason and All Right in Poverty Flats ground. The work has reached a depth of 265 ft., and will be continued to 330 ft. At this point driving will be undertaken to cut the large bodies of manganese believed to extend into the property from the Jason.

The manganese output from this district has decreased temporarily, but new work in progress at several properties is expected to result in a heavy production before the end of the year.

The Climax Molybdenum Co. closed down temporarily on October 23 to take steps toward overcoming the influenza epidemic which claimed 11 victims in 10 days. The entire workings and plant will be systematically fumigated and operations renewed at an early date.

RENO, NEVADA

Consolidated Coppermines.—Cinnabar Near Mina.—Old Orizaba Silver Mine Being Re-opened.

The Consolidated Coppermines Co. at Ely in September produced 1,196,884 lb. of copper. The mill at Kimberly recovered 79%, which is better than in August. Repair parts for pumps have been received, and the mine is being unwatered from the 1200 to the 1400-ft. level. Development at 1200 ft. in three cross-cuts is said to have exposed 9% ore at two points. Work will now proceed on the 1300-ft. level, which was flooded following the interruption to pumping. Satisfactory conditions in the Alpha ground are reported by F. H. Probert, of the University of California, who was employed by the company last spring and again in September to examine this ground. He declares the results of recent work have been encouraging, and regular shipments of high-grade oxidized ore have been maintained.

High-grade cinnabar is being opened in the Cinnabar district, a short distance east of Mina, in Mineral county. Lessees on the Keough & Pepper property have erected retorts and are shipping quicksilver, one of them at the rate of a flask daily. Three of the leases, worked by F. Elges, Tom Miles, and Al Drew, are producing and will put in more retorts. Cinnabar prospects north-east and south-west of Mina are being prospected with encouraging results.

Development of the Orizaba mine in Nye county, 36 miles north of Millers, will be resumed under the direction of J. K. Turner, consulting engineer for the Diamondfield Black Butte Mining Co., which controls the Orizaba. An examination revealed ore at a number of points, but the old workings are flooded to the 95-ft. level. In the past five years the mine has produced $23,000 in shipping ore from above this level. The obsolete steam-driven equipment, which was found inadequate to cope with the heavy flow of water, will be replaced by a modern plant, with motive power supplied by a distillate engine. Additional work will be done on the 65 and 95-ft. levels to prove the limits of the ore-channel, and a new main shaft will be sunk. An average of all Mr. Turner's samples above $9 indicated that the vein has an average width of 3½ ft., assaying $19.32 per ton, nearly all silver. Three dumps sampled contain ore valued at $44,730. The mine is an old producer of rich silver ore, chiefly from surface stopes, and its purchase has been sought by several of the large Tonopah and Goldfield companies, whose engineers have sampled it and placed a high appraisement on it.

GOLD HILL, OREGON

Gold Mining Very Dull.—Chrome Men Organize.—Manganese Deposits not Satisfactory.

Never has there been so little doing in gold mining in southern Oregon as at present. The only properties in operation in Jackson county are the Sylvanite group, three miles north of Gold Hill, and the Nellie Wright claims three miles east. Only the larger hydraulic placer mines, which are saving platinum, will operate during the coming season. All of the smaller properties have suspended during the period of the War.

Chrome producers of southern Oregon and northern California met recently at Grants Pass and organized the Oregon Chrome Producers' Association, which will affiliate with the Pacific Coast Producers' Association, organized at San Francisco last month. The operators who have been induced to develop chrome in this region on the theory that the production would be paid for at prices prevailing during the past summer have been unable to get the money back they spent. The Association is not endeavoring to protect people in the opening of new deposits, only those who are already developing.

Victor Rakowsky of Joplin, Missouri, who early in the season took options on the Manganese Metals Co.'s and adjoining manganese deposits in the Lake Creek district east of Gold Hill, after doing extensive churn-drilling, was not able to prove sufficient ore to justify his proposed 500-ton reduction works. The concentrate from the manganese ore of these deposits averages 0.10 oz. gold; 12.5 oz. silver; 1.2% iron; 53.5% manganese; and 0.16% phosphorus. About 1500 tons of ore, containing 15% manganese, is available. In addition, incomplete prospecting by drilling and open-cuts indicate that at least four acres are probably underlain by 10 ft. of 10% ore, which will yield 120,000 tons; while the surface indications on adjoining deposits will warrant an estimate of 130,000 tons additional, making a probable reserve of at least 250,0000 tons.

Manganese mining is a new industry in the Lake Creek district, actual development having been begun late in 1917. Since the first of March 1918, the Manganese Metals Co., a Tacoma, Washington, concern, has been operating a 20-ton mill on the property, producing a 45% manganese concentrate. Since this company began operations the known limits of the manganiferous area have been considerably extended by prospectors, and a large number of claims have been located. The wagon-haul from April to November to Eagle Point, the shipping-point a distance of 17 miles, costs $4 per ton. Electric power is available from a transmission-line at Eagle Point. Minimum wages are $5.

ARIZONA

Benson.—The Arizona United Mines Co., operating in the Johnson district, is shipping four cars of copper ore daily. The orebody is reported to be 160 ft. wide on the 900 and 1100-ft. levels. A. C. Harmer is general manager.

Los Conquistadores mine, 12 miles north of Benson, heretofore considered a gold producer, shows a large body of gold-silver-lead ore on Carolina No. 1 and 2 claims. This should finance considerable development. Preparations are under way to commence shipments to El Paso.

Chloride.—It is reported that a good body of ore has been opened in the Bay State mine, which is being operated by the Hughs Copper Company.

The Schuylkill Mining Co. is reported to have obtained permission from the Government to get the machinery for the new 500-ton concentrating plant. The north drift on the 900-ft. level of the Tennessee mine is said to have reached the line of the Schuylkill, and has opened a large body of lead ore. This ore is supposed to be the same shoot encountered on the 600-ft. level.

The Chloride Queen Mining Co., one mile north of the Tennessee, is driving on the orebody from the surface and is rapidly gaining depth. This drift within the last week showed indications of ore similar to that encountered in the Schuylkill and Tennessee. The orebody has widened to 18 in. and is said to run as high as $95 in silver per ton.

Constellation.—A wide body of sulphide ore, assaying 12% copper, 5 oz. silver, and $5 gold per ton is said to have been cut at a depth of 700 ft. in the old Abe Lincoln mine; while in a tunnel there is 10 ft. of 45% copper, 12 oz. silver, and $10 gold ore. This mine is on the same formation as the Monte Cristo silver mine. Charles Mathorst is superintendent. The Abe Lincoln is 13 miles east of Wickenburg, which place is much excited over these developments.

Douglas.—During October, 454 cars of ore and concentrate was shipped into the United States from Mexico through this 'port of entry' from Sonora. The estimated value placed on the ore by the Mexican government is ₱2,875,500.

Hercules.—The town of Belgravia, where is situated the mill of the Ray-Hercules company, has been re-named Hercules. A. A. Wren is general manager.

Metcalf.—Shannon produced 800,000 lb. of copper in October, the highest output since May.

Miami.—The Van Dyke Copper Co. is to sink a 1500-ft. shaft to exploit an orebody cut by drilling between 1156 and 1220 ft. The ore assayed 7% copper, and is considered to be an extension of the Miami Copper Co.'s deposit. C. W. Van Dyke is manager.

CALIFORNIA

Alleghany.—A 10-stamp mill is being erected at the Sixteen-to-One mine here. It is a plant moved from a property near Washington.

Placerville.—The old Union mine, in the Nashville district, is to be re-opened by a Los Angeles syndicate, early in 1919. D. I. Hunt will be in charge.

Portola.—No. 7 diamond-drill hole at the Walker mine is reported to have passed through 25 ft. of 5% copper ore.

Quincy.—The Feather River Gold Mining Co. is said to be constructing a four-mile ditch for hydraulicking in the spring.

Redding.—The flotation plant at the Bully Hill mine started on November 13. It cost $75,000 and has a capacity of 150 tons per day. This is the third flotation plant in Shasta county.

San Francisco.—The California State Mining Bureau has issued Preliminary Reports No. 4 and 5. The first deals with antimony, graphite, nickel, potash, strontium, and tin, and was compiled by E. S. Boalich and W. O. Castello. The other bulletin, by the same authors, covers tungsten, molybdenum, and vanadium. Those interested will find useful information on these minerals, lists of producers, and remarks by consumers.

Trinity Center.—Twenty-five auto-trucks are on the road between Trinity Center and Redding, all hauling machinery for the new Estabrook dredge at this place. Though there is 1200 tons, it is expected that the job will be completed before snow blocks traffic.

Trona.—The American Trona Corporation in 1917 made 14,730 tons of crude and 516 tons of refined potash. The total income was $1,950,154, of which $717,094 was profit. During the year, $1,014,913 was spent on plant construction; for seven months of 1918 this item was $888,804. The works erected at San Pedro, near Los Angeles, are to be removed to Searles lake. From January 1 to July 30, 1918, the output was 11,283 tons of crude and 1692 tons of other potash salts.

IDAHO

Kellogg.—The Caledonia Mining Co. will reduce its monthly dividend from 3 to 1c. per share on January 5. Development has failed to find new ore. On September 30 there was on hand $124,698 of cash, $325,000 of Liberty Bonds, $76,869 due from smelters, less current accounts of $8564, leaving $518,003 net. In the 9 months ending the above date the output was 4,449,280 lb. of lead, 510,734 oz. of silver, and 70,439 lb. of copper. After paying all charges there was a net profit of $485,443.

KANSAS

Baxter.—The Blue Mound Mining Co. is operating six drills on its leases. With the Blue Diamond company under the same control, five shafts and two mills are working. Their output last week was 250 tons of concentrate, a good deal of which receives $75 per ton.

MISSOURI

Bonne Terre.—St. Joseph Lead Co. pays 50c. per share on December 20. This is equal to $732,389.

Joplin.—Production of the Tri-State fields last week was 5438 tons of blende, 763 tons of calamine, and 1414 tons of lead. The average value was $60, $41, and $100 per ton, respectively, making a total of $551,258, and $22,438,708 for the year.

Eight smelting companies paid the agreement price of $55.67 per ton for second-grade zinc ore during the past week, though most of them were in the market for comparatively small amounts, according to the 'Globe'. A few

smelters that continued to decline to the agreement ratio on prices, paid from $50 to $52.50 for what ore they bought. Total sales were below normal by several thousand tons, as was the case a week ago. It is understood that several of the larger smelters have had much trouble with labor shortage, due to influenza. Producers are inclined to be pleased with the progress of the agreement. They point out that while demand is poor, it would have been poor under existing circumstances in any event, and the agreement appears to have saved from $2.50 to $5 per ton on ore prices in the past week, which is not insignificant. It is hoped that another week will find all smelters buying on the agreed ratio.

An appeal has been issued by the Zinc Ore Producers Committee urging producers to sell ore only to the smelters who have signed the new price agreement. The following is a statement issued by the Committee last week:

"The following smelters purchased ore last week on the new ratio scale, calling for a price of $55.67 per ton for 60% blende ore: New Jersey Zinc Co., Hegeler Zinc Corporation, Grasselli Chemical Co., American Zinc, Lead & Smelting Co., Eagle-Picher, Kusa Spelter Co., and United States Zinc Corporation. The total tonnage purchased was approximately 2400 tons, a rather disappointing total, but considering the peace talk and the probable temporary effect of peace on the zinc industry it is not surprising. It is gratifying to the committee, however, to know that all smelters who have signed the schedule are showing good faith in purchasing ore, and we trust soon to have the cooperation of the few remaining smelters who purchase ore in this district. The latter smelters bought 1300 tons of ore at from $52.50 to $55 per ton, and if this district expects to live up to the schedule adopted, it is unfair to those smelters who have signed to undersell to competitive smelters. The present war situation, we feel, is responsible for dullness of the ore market, and this situation may last for some time, and it is up to all producers to sit tight and play the fair game."

NEVADA

Virginia City.—Whitman Symmes, superintendent of the North End mines, announced on the 13th that a plan he had long favored to reduce expenses, by ceasing pumping in the lower and at present unworked levels of the Comstock, would be put into effect. All of the work is above the 2600-ft. level, and the mines will be allowed to fill up to a point somewhere below that, thus saving the cost of much pumping, which is unnecessary.

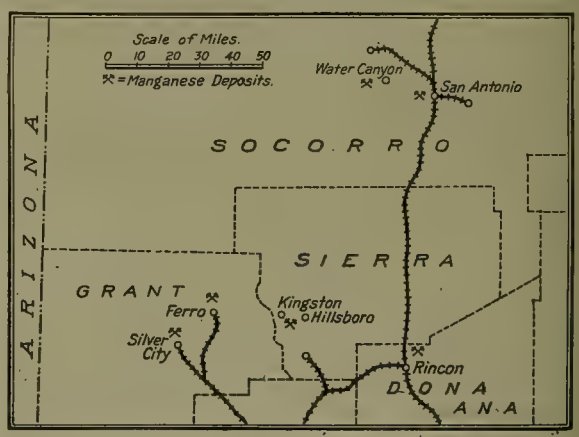
NEW MEXICO

For several years New Mexico has produced manganiferous ores from deposits in the Silver City district. In 1917 it made a small output of high-grade ore from other deposits, and in 1918 it may considerably increase its output by exploiting newly-discovered deposits and by working old silver mines for manganese ore. Many of the deposits now mined are in the west-central and south-western parts of the State, and most of them have been examined by geologists of the U. S. Geological Survey. The deposits near Fierro, in Grant county; those in the Lake Valley, Kingston, and Hillsboro districts, Sierra county; those near Rincon, Dona Ana county; and those near Water Canyon, San Acacia, Socorro, and San Antonio, Socorro county, were examined in August 1917 and July 1918 by E. L. Jones, Jr., of the Survey.

These manganese deposits occur in veins, brecciated zones, and as replacements. They may be further classified as manganiferous-silver deposits and deposits free from silver and other metals. The manganiferous-silver deposits are veins formed in fissures and replacements near fissures, both in massive Paleozoic limestone. The deposits free from silver are principally in brecciated zones and veins, but include minor replacements of wall rocks and are enclosed in Tertiary lavas and in sandstone of Tertiary or later age.

Manganiferous-silver ore occurs in two veins that cut massive Paleozoic limestone two miles north-east of Fierro. The veins are persistent and can be traced for several thousand feet along their course. The vein-matter is a mixture of iron and manganese oxides and silicified limestone, and is low grade; but it could probably be sorted or concentrated to form a marketable product. Manganese oxides are manganite and pyrolusite, but the workings have not passed through the oxidized zone so as to disclose the unoxidized manganese minerals.

The Lake Valley mine, a famous producer of silver ore in the 'eighties, at Lake Valley, the terminus of a branch line of the Santa Fe railway, promises to become an important producer of manganese ore. In the later part of 1917 the old workings were being re-opened and some shipments of selected ore were made from the old dumps. There is a large reserve of low-grade material on the dumps, and if some method of beneficiation could be economically employed the mine would yield a large quantity of ore. The ore was mined by 10 or more shafts, the deepest extending to ground-water level, which stands at a depth of 150 ft. The ore deposit consists principally of lead, zinc, and silver minerals, which are contained in a gangue of manganese and iron oxides, quartz, calcite, and silicified limestone. The silver ore shipped during one year contained, as reported by the company, an average of silver, 47.7 oz. per ton; lead, trace; zinc, 4%; silica, 28.5%; iron, 13.9%; and manganese, 18.2%. In the later part of 1917 the shipments of manganese ore sorted from the dumps ranged from 35 to 39% manganese, 12 to 15% of iron, 7 to 11% of silica, and about 0.05% of phosphorus.



MAP SHOWING MANGANESE DEPOSITS IN NEW MEXICO.

The Comstock, Lady Franklin, and Iron King mines, of the Kingston districts, are old producers of silver ores and contain low-grade manganese deposits. Most of the old workings are now inaccessible and the ore-reserves could not be estimated. The deposits are in part fillings of fissures and in part replacements of limestone. The manganese deposits in the Kingston district are too low grade and too remote from rail to be of value at present.

Near Hillsboro there are several deposits in fissures and shear-zones that cut Carboniferous limestone. The deposits are small and low grade, and the chief interest attached to them is the occurrence, in a deposit owned by Nichols & Lannon, of large well-developed crystals of the lead molyb-

date, wulfenite, and the lead vanadate, vanadinite, which are associated with soft manganese oxides.

The deposits near Rincon consist of numerous small veins that cut red sandstone and a conglomerate of volcanic pebbles. The orebodies are small, no ore-shoot having been traced more than 50 ft. along the strike of the vein, and they range in thickness from that of a knife-blade to 20 in. Their extreme depth is not known, but one vein persists to an observed depth of 20 ft., and another was reported to persist to the bottom of a shaft 66 ft. deep. The vein material consists of manganese oxides, barite, and calcite, which in places enclose fragments of wall-rock. Psilomelane is the principal manganese oxide and occurs commonly in mammillary crusts, several inches thick attached to coarse crystals of barite, and also of masses composed of nodules of various sizes. The interstices of these nodules are lined with thin films of a black-manganese oxide which has a velvety surface and which is believed to be manganite. Sorted ore from these deposits contains 45.2% manganese, 3.7% iron, 3.5% silica, 0.02% phosphorus, and 10.3% barium oxide.

Most of the deposits in Socorro county are small, and are contained in brecciated zones and narrow fissures in rhyolite and rhyolite tuff. Production from deposits of this type has been made largely from one property, that in Water Canyon, operated by Butler & Myers. From June 1917 to June 1918 this property produced 1500 tons of ore containing 40% manganese, less than 2% iron, and from 8 to 22% silica. Other deposits of this type are found near the mouth of Six Mile canyon, on the eastern slope of Socorro peak, 3 miles west of Socorro; in La Plata canyon, 10 miles west of San Acacia; and at several places in the southern foothills of the Socorro mountains 6 miles west of San Antonio.

The brecciated lava in most of these deposits is cemented with manganese oxides in seams that are too small to permit hand-sorting, but the material appears to be admirably adapted to some form of mechanical concentration. The deposit in Water Canyon, however, is contained both in rhyolite breccia and rhyolite tuff. The rhyolite breccia extends for a few feet from the surface and is underlain by a bed of tuff which is partly replaced by manganese oxides in a deposit from 2 to 8 ft. thick. The orebody terminates on the east against a northward-trending fault. Most of the brecciated zones and veins are less than 100 ft. long, and the ores will probably become exhausted at shallow depths. Psilomelane is commonly found in the outcrops of these deposits and scattered vugs in the psilomelane contain crystals of manganite. At depths of a few feet the manganese oxides are softer and pyrolusite predominates. Calcite accompanies the ore, but quartz is absent except that which is included in fragments of the country rock.

Hanover.—The Empire Zinc Co. is to enlarge its mill to 250 tons capacity.

OKLAHOMA

Picher.—Production of all districts last week amounted to 3984 tons of blende and 1086 tons of lead, valued at $397,720.

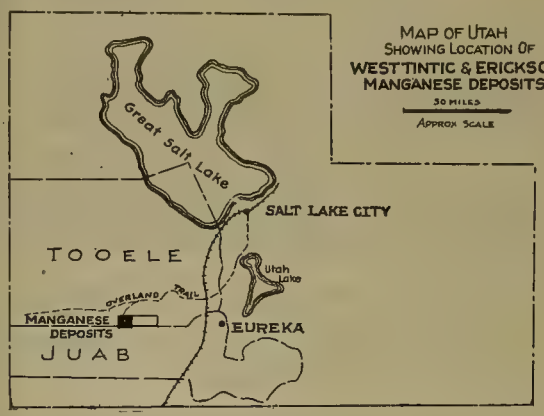
SOUTH DAKOTA

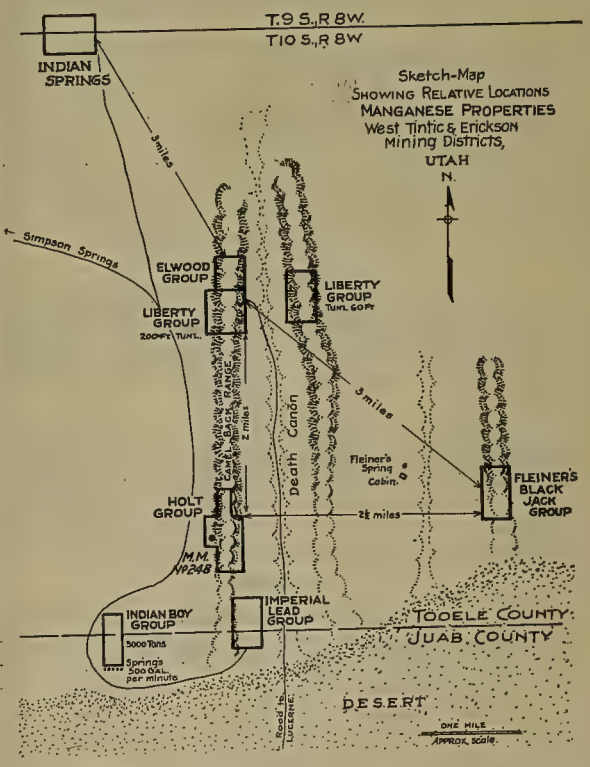
Lead.—The Homestake Mining Co. pays its monthly dividend of 50c. per share on November 20. Owing to the labor shortage the company has hung-up 100 stamps at the Mineral Point mill. This leaves 920 stamps dropping in the other five plants.

UTAH

Bingham.—The superintendent of the Montana-Bingham, J. B. Leggett, estimates that the principal copper orebody contains 1,500,000 tons of 2% material, plus a large quantity of milling ore in the Mayflower drift.

Tintic.—The accompanying maps show the location of the manganese deposits in the West Tintic and Erickson districts. An investigation was made by J. T. Pardee, of the U. S. Geological Survey, in June 1918. The Tip Top tunnel, and a mine in the Black Jack group, are together producing 450 tons monthly. If cheap haulage to rail could be secured the district could yield several times its present output.





Eureka.—The Chief Consolidated Mining Co. has issued its report for the quarter ended September 30, 1918. The net profit was $119,931. A dividend of 12½c. per share, equal to $110,528, was paid on August 3. Including a like amount on November 1, the total is $1,234,871. Current assets total $257,046, plus $433,482 in Liberty Bonds, and $399,761 cash, a total of $1,090,288. Current liabilities amount to $95,860, plus $258,588 for taxes and for No. 2 shaft. A total of 4312 ft. of work was done, including sinking No. 22 shaft 222 ft. This shaft was down 265 ft. on October 22, in porphyry, which rock may continue for

1500 ft. The shaft will be concreted the whole distance. Six prospecting drifts were put in on the 1800 and 1000-ft. levels, and 18 drifts and raises in ore-zones on the 800, 900, 1000, 1200, 1600, 1800, and 1900-ft. levels. High-grade ore was found at 1200 ft. Ore shipments were 19,436 tons, assaying 0.037 oz. gold, 30.8 oz. silver, and 10.87% lead. Manganese ore—74 tons—contained 38.15% Mn.

CANADA

British Columbia

Greenwood.—The smelter of the Canada Copper Corporation, in operation since early in 1901, is to close-down, according to an announcement by Hugh R. Van Wagenen, general manager. The news has had a depressing influence on the business men and residents of Greenwood and adjacent district, who are endeavoring through the Government and by other means to induce the management of the company to alter its policy. Mr. Van Wagenen issues a statement with reference to the decision reached which reads as follows:

"I wish to say that due to the fact that the Mother Lode mine contains now ore of a grade insufficient to meet present-day costs and because the quality of coke which is obtainable is so inferior, and because freight, wages, and supplies are all so costly under war conditions that to develop our Phoenix (B. C.) mines is inadvisable at this time, we are going to discontinue smelting operations at Greenwood and cease mining at the Mother Lode.

"For just what time this shut-down will continue is impossible to foretell. It will require a return to more nearly normal supply of labor and of costs than prevails today to encourage us to expend money necessary to lay the foundation for an operation in this district. We have much faith in our Phoenix mines and in the Lone Star, and there are encouraging prospects at two other of our properties. It is my personal belief that we will eventually re-open our Boundary operations, but I can give no assurance."

MEXICO

Cusihuiriachic.—The Compañia Minera del Mirasol has C. B. Clyne of the Mills building, El Paso, Texas, preparing plans for a 200-ton concentrating plant. E. W. Enriquez is in charge at the mines. Ore is being shipped to smelter at Chihuahua.

Coahuila

Saltillo.—The Mazapil Copper Co. is only operating at half capacity. The smelter at Concepcion del Oro in Zacatecas is producing 400 tons of 51% matte monthly. R. H. Jeffries is general manager. H. Snyman, mine superintendent for 8 years, recently arrived at El Paso, Texas.

Nuevo Leon

Monterrey.—Mining men and ore exporters in Mexico are considerably exercised over the promulgation by the constitutionalist railways of Mexico of a new and higher schedule of freight-rates on certain kinds of ore destined for export. While the new rates are upon a mileage basis, they amount practically to a horizontal increase of approximately 33%, it is claimed. As an illustration, the new rate applying between Chihuahua and El Paso, 361 kilometres, is given: The rate on first-class ore, ₱50 or upward valuation, is raised from ₱6.62 to ₱8.41 per ton, an increase of ₱1.79; on second-class ore, ₱30 to ₱50 valuation, the rate has been raised from ₱5.52 to ₱6.73 per ton, an increase of ₱1.21; third-class ore, under ₱30, ₱3.80 to ₱4.38 per ton, an increase of 58 centavos. Fourth-class ore is not mentioned. Old rates obtain as to shipments of zinc, antimony, and manganese. It is reported that an international bridge toll of ₱2 per ton will be levied in addition to the increased tariff on exported ores.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Frank L. Bosqui is in New York.

R. B. Robertson of Butte is here.

J. Power Hutchins is at the Palace hotel.

H. C. McNaught, of Denver, was here this week.

George Crerar, recently at Dayton, Nevada, is here.

Giovanni Bruscantini, of Santiago, Cuba, is in San Francisco.

R. B. Lamb has moved his office to 15 Broad street, New York.

F. M. Field has returned to Los Angeles from Virginia City, Montana.

Louis Braun is the new manager of the Winona mine at Houghton, Michigan.

E. M. Hamilton, of Hamilton, Beauchamp & Woodworth, has returned from Mexico.

Arthur Winslow is here from Boston, on his way from Oregon to Telluride, Colorado.

Henry H. Armstead has been transferred to the Corps of Engineers, U. S. Army with promotion to Major.

Fred. Hellmann and **F. S. Shaw** are making visits of inspection to the mines controlled by the Guggenheims in Mexico.

W. H. Landers, promoted to Major in the Engineers, has returned from France on special duty and is now at Washington.

J. Austen Bancroft, professor of geology in McGill University, has returned to Montreal from a geological reconnaissance at Anyox, B. C.

C. Erb Wuensch has resigned his position with the A. S. & R. Co. at Leadville and is now engaged in experimental work at Golden, Colorado.

L. R. Robins, engineer and geologist for the Tonopah Belmont company, has been promoted to the position of mine superintendent at Tonopah.

E. A. Collins, for five years Inspector of Mines for the Ontario government, has resigned to take a position with the International Nickel Company.

William Fleet Robertson, Provincial Mineralogist for the Province of British Columbia, has returned from Montreal, Quebec, where he went, under instructions, to test the cable used in the Protection shaft of the Western Fuel Co. of Canada, the breaking of which allowed a cage, loaded with miners on their way to work, to fall, carrying its passengers to instant death.

Obituary

J. J. Morrison, manager of the Empire Zinc Co., at Hanover, New Mexico, died on October 9.

Carl Evans, superintendent for the United Gold Mines Co., died from the effects of influenza on November 8.

Charles R. Van Hise, president of the University of Wisconsin, a geologist of international reputation, died at Milwaukee, on November 19 from meningitis. He was a native of Wisconsin, having been born at Fulton in 1857. He had returned only three weeks before from the European zone of war, having gone thither as a member of a mission appointed to study the problems of reconstruction. By mining engineers he was held in the warmest regard on account of his high character and his important contributions to the study of ore deposits.

THE METAL MARKET

METAL PRICES

San Francisco, November 19

Aluminum-dust, large and small lots, cents per lb.	65—70
Antimony (wholesale), cents per pound.	11.00
Copper, electrolytic, cents per pound, in carload lots.	26.00
Copper, electrolytic, cents per pound, in small quantities.	27.35
Lead, pig, cents per pound.	8.30—8.80
Platinum, Government price, per ounce.	$105
Quicksilver, per flask of 75 lb.	$120
Spelter, cents per pound.	11.00
Zinc-dust, cents per pound.	16.00

ORE PRICES

November 19

Chrome, no definite quotations available.

Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2.	$1.25
Pyrite, per unit of sulphur, cents.	28—32
Tungsten, 60% WO_3, per unit.	$20—$26

Chrome will be found discussed on our editorial pages of this issue—also manganese.

EASTERN METAL MARKET

(By wire from New York)

November 19.—Copper and lead remain unaltered. Spelter is dull and easy.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 49½ pence.

Date	New York,	London	Average week ending	
Nov. 13	101.12	49.50	Oct. 8	101.12
" 14	101.12	49.50	" 15	101.12
" 15	101.12	49.50	" 22	101.12
" 16	101.12	49.50	" 29	101.12
" 17 Sunday			Nov. 4	101.12
" 18	101.12	49.50	" 12	101.12
" 19	101.12	49.50	" 19	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63 06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68 51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67 86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date		Average week ending	
Nov. 13	26.00	Oct. 8	26.00
" 14	26 00	" 15	26.00
" 15	26 00	" 22	26.00
" 16	26.00	" 29	26.00
" 17 Sunday		Nov. 4	26.00
" 18	26 00	" 12	26.00
" 19	26.00	" 19	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

A committee of copper producers and refiners agreed with the War Industries Board on November 15 to maintain the present rate of production and preserve existing levels of prices and wages. Government regulation of prices and allocation of materials will continue, the entire agreement to remain in effect until January 1, when it will be subject to renewal or revision. In making this announcement after an all-day conference, members of the committee and officials of the Board explained that the action was taken to stabilize the copper industry and those with which it is closely related during the period of transition from a war to a peace basis.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Nov. 13	8.80	Oct. 8	9.31
" 14	8.75	" 15	9.02
" 15	8.60	" 22	9.08
" 16	8.55	" 29	9.04
" 17 Sunday		Nov. 4	8.96
" 18	8.50	" 12	8.91
" 19	8.50	" 19	8.62

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date		Average week ending	
Nov. 13	8.05	Oct. 8	8.05
" 14	8.05	" 15	8.05
" 15	8.05	" 22	8.05
" 16	8.05	" 29	8.05
" 17 Sunday		Nov. 4	8.05
" 18	8.05	" 12	8.05
" 19	8.05	" 19	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefore $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
Oct. 22	120.00	Nov. 4	120 00
" 29	120.00	" 12	120 00
		" 19	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	78.82
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91 00	Dec.	42.55	85.00	....

Tin is quoted at around 75 cents per pound.

MANGANESE

Manganese alloys: Domestic production of ferro-manganese, averaging 65 to 70% Mn, was over 35,000 gross tons in October, the largest of any month on record, according to 'The Iron Age'. This included also most of the electric-furnace output. The production of spiegeleisen in October was also over 35,000 tons, the second largest recorded month. Demand for both was almost nothing during the past week.

Eastern Metal Market

New York, November 13.

The advent of peace and its effect on both controlled and uncontrolled markets is the sole topic interfering with what little business there was in open markets. Two practically unexpected holidays in the past week, the 7th and 11th, have also been interfering factors.

Copper conditions continue unchanged for the present.

The tin market is dead, with consumers and even sellers uncertain as to its future.

The lead market is analagous strictly to the copper.

Demand for zinc is light, and quotations are nominally easier.

Antimony has again declined.

Problems of more magnitude than has ever before been experienced in re-adjustment of prices and uses of steel confront the steel trade. For the first time in its history it enters on a period of transition with the Government in practical control of both output and distribution. Some restrictions on certain lines of steel consumption have already been announced following the actual or scheduled cancellation of large quantities of war steel. Shell-steel and barbed wire contracts are the first to feel the effects of peace. A meeting is being held in Washington today between the War Industries Board and the steel committee of the American Iron and Steel Institute to confer on general re-adjustment problems. Price questions are having serious consideration, and it is generally expected that they will come down. The machine-tool trade is much concerned over efforts of buyers to cancel orders placed without conditions.

COPPER

Speculations as to the future control of the market, which apply to copper, apply also to lead and steel. Nothing definite is yet known as to the policy of the Government. Copper prices have been fixed at 26c. per lb. to January 1, and it is probable that this will hold until that date, though it is not certain. It is too early to form definite opinions. It is believed that Government control will continue for some time, and that the transition from war orders to peace will be gradual and orderly. Unquestionably the 95% of output that has been estimated as going into war work will be gradually lessened so that the famished domestic needs may be satisfied in time. When an open market will obtain no one knows, but it is certain that at 26c. per lb. profits in most cases are satisfactory. At present there is an absence of any new business, with the tone of the market easier. An authority estimates the output of refined copper at 208,800,000 lb. per month for the past 10 months of the year. Imports of copper are estimated at 47,700,000 lb. per month to November 1, with exports at 67,200,000 lb. per month. Casting copper continues easy and under the maximum at 25.50c. per pound.

TIN

Just as an international control of the tin market is being put into effect there comes the announcement of a cessation of hostilities. This has in fact added to the confusion already existing by introducing the question as to whether this new control will endure long or not or at least to what extent it will be carried out. The market is devoid of activity or interest. There has been no buying, even of small lots en route or to arrive, the quotation for spot metal standing nominal at 75c., New York. It is a matter of relief that the question of import licenses on old contracts has been cleared up, for it is now settled that importers can obtain licenses for such importations as are necessary to fill contracts which they can prove were made prior to October 1. The importers' association continues to hold meetings, and it is understood that they have an alternative plan to offer to the Government. An interesting statement has just been published to the effect that stocks in consumers' hands in this country, together with those en route as purchased, is enough to supply the country's needs for the next six to eight months. It is also a fact that the present price of 75c. is over twice what it was when the War broke out, at which time it was 34c. per lb. Total arrivals in November, to the 8th, were 1025 tons, of which 925 tons have come in at Pacific ports. The London market has declined to £327 per ton for spot Straits.

LEAD

There has been no change in the situation. Prices and distribution continue under strict control, with output well sold-up to the end of the year. Whether the decreased need of lead for munitions will affect supplies for domestic purposes is an interesting question, but there is nothing definite. Quotations, fixed by agreement, continue at 7.75c., St. Louis, or 8.05c., New York. There is a statement to the effect that Japanese firms have requested bids for lead shipments from Japan, as well as for metal made from imported ores held in this country, which they may not find it possible to ship to the Far East.

ZINC

It is believed that the Government will take all the zinc orders for November and December shipment, and that prices will not undergo any radical revision. The market is quiet with demand extremely light. Prices are nominal with nearby and November deliveries of prime Western quoted nominal at 8.40c., St. Louis, or 8.75c., New York, and December deliveries at 8.20c., St. Louis, or 8.55c., New York. For first quarter the quotation is nominal also at 7.95 to 8c., St. Louis, or 8.30 to 8.35c., New York. The Government report for the week ended November 2 shows a slight decrease in output and a decline in stocks of over 2600 tons.

The maximum Government price for grade A zinc is 12c. per lb., with that of sheet-zinc at 15c. per lb., and of plate-zinc at 14c. per pound.

ANTIMONY

The effect of a cessation of hostilities has been more marked on the antimony market than on any other. Quotations have fallen still further until wholesale lots for early delivery are held at 9.50c. per lb., New York, duty paid.

ALUMINUM

For No. 1 virgin metal and for scrap a Government maximum price of 33c. per lb. for 50-ton lots, of 33.10c. per lb. for 15 to 50-ton lots, of 33.20c. per lb. for 1 to 15-ton lots prevails until February 1, 1919.

ORES

Antimony: Again there have been no developments.

Manganese: The last quotation heard in this market was $1.15 per unit for imported ore. Consumers are awaiting developments for they know that pre-War prices were less than one-fifth of the present.

Molybdenum: The market is devoid of interest with no way to gauge market value.

Tungsten: The War has so changed future possibilities of this market that there is no demand and no way to gauge prices. It seems certain that the last levels quoted of $19 to $26 per unit could be measurably shaded were there any need to buy. The same is true of the ferro-tungsten market.

Book Reviews

Mine Tracks: Their Location and Construction. By J. McCrystle. Pp. 105, ill., index. McGraw-Hill Book Co., New York, 1918. For sale by 'Mining and Scientific Press.' Price, $1.50.

Well-laid tracks in or about a mine are of great importance, and the rapid movement of ore or other materials is expedited thereby. At small mines, the laying of tracks is generally an easy matter; but at large mines, where heavy cars and locomotives of various kinds are used, a good roadbed and heavy rails are essential. At one time, and it is still done, many companies made their own switches, etc., but they now find that standardized equipment is best purchased from specialists in the business. In the eight chapters of this practical little work we find sensible remarks on rails and joints, ties and ballast, calculation of haulage roads, grades and drainage-ditches, frogs and switches, and rules governing the upkeep of tracks. Altogether, we find this book worth a place in the engineer's library.

Bibliography of Foreign Trade Publications. By H. S. Shuey. Pp. 77. The ten Bosch Co., San Francisco, 1918. For sale by 'Mining and Scientific Press.' Price, $1.50.

The author of this work is lecturer on commerce in the University of California, and is well fitted to compile such a needed reference, especially at this time when our foreign trade is expanding. Commercial organizations have felt the need of a bibliography of publications dealing with foreign-trade subjects, so here they will find what they want. The contents, reading alphabetically, cover atlases, commercial policies and tariffs, directories, export journals, financing, foreign markets for all commodities, geography and commerce, history of international trade, house publications, insurance, magazines, publications of commercial organizations, statistics, technique, theory of international trade, transportation and trade routes, and year-books. A fair review of a book like this is difficult, as we know what an immense amount of reference has been needed, yet cannot adequately explain it; however, those that are engaged in foreign trade or are interested will find here where they can procure the particular subjects they desire to study.

Electro-Analysis. By E. F. Smith. Sixth edition. Pp. 344, ill., index. P. Blakiston's Son & Co., Philadelphia, 1918. For sale by 'Mining and Scientific Press.' Price, $2.50.

This revised and enlarged edition shows that the previous ones have been popular, and that electrolytic methods of analysis are being used more and more. At copper mines, probably more than at any other metal mines, we find electro-analytical methods used. Twenty-three pages are devoted to discussions on the rapid precipitation of metals in the electrolytic way, 117 pages to the determination of metals, and 93 pages to the separation of metals. Other special applications of the process occupy the remainder of the book, including a chapter on the combustion of organic compounds. Electro-analysis permits of clean, accurate, and rapid determinations, where ordinary methods are unsatisfactory. Necessary apparatus is well described and illustrated. Those who use electrolytic methods should find this work right up to date.

Green Book for Buyers. Fall edition, 1918. 3¼ by 7 inches. Pp. 420, index. Oil, Paint and Drug Reporter, 100 William street, New York.

From abrasives to zinkite, this useful little reference contains the names of manufacturers and larger dealers in the United States.

Recent Publications

U. S. Bureau of Mines, Washington, D. C., 1918:

Efficiency in the Use of Oil-Fuel. A handbook for boiler-plant and locomotive engineers. By J. M. Wadsworth. Pp. 86. Ill., charts, index.

Gold Dredging in the United States. By Charles Janin. Bulletin 127. Pp. 226. Ill., plans, index.

Low-Rate Combustion in Fuel Beds of Hand-Fired Furnaces. Technical Paper 139. By Henry Kreisinger, C. E. Augustine, and S. H. Katz. Pp. 54. Ill., index.

Measuring the Temperature of Gases in Boiler-Settings. Bulletin 145. By Henry Kreisinger and J. F. Barkley. Pp. 72. Ill., index.

Suggestions for Improved Methods of Mining Coal on Indian Lands in Oklahoma. Technical Paper 154. By J. J. Rutledge and Daniel Harrington. Pp. 31. Illustrated.

Methods of Routine Work in the Explosives Physical Laboratory of the Bureau of Mines. Technical Paper 186. By S. P. Howell and J. E. Tiffany. Pp. 63. Index.

Methane Accumulations from Interrupted Ventilation. With special reference to coal mines in Illinois and Indiana. Technical Paper 190. By H. I. Smith and R. J. Hamon. Pp. 43. Illustrated.

Production of Explosives in the United States in 1917. Technical Paper 192. Compiled by A. H. Fay. Pp. 19.

Tars Distilled from Bituminous Coal in Hand-Fired Furnaces. Technical Paper 195. By S. H. Katz. Pp. 17. Illustrated.

Use of the Hydrogen-Volatile-Matter Ratio in Obtaining the Net Heating Value of American Coals. Technical Paper 197. By A. C. Fieldner and W. A. Selvig. Pp 11. Illustrated.

Colloids and Flotation. Technical Paper 200. By F. G. Moses. Pp. 22.

Economic Operation of Steam Turbo-Electric Station. Technical Paper 204. By C. T. Hirshfeld and C. L. Karr. Pp. 27: Illustrated.

Saving Coal in Boiler-Plants. Technical Paper 205. By Henry Kreisinger. Pp. 21. Illustrated.

Coke-Oven Accidents in the United States in 1917. Technical Paper 206. Compiled by A. H. Fay. P. 18.

How to Improve the Hot-Air Furnace. Technical Paper 208. By C. W. Baker. Pp. 17.

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INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

LITTLE GIANT CORNER DRILLS

The Little Giant corner or close-quarter drill, manufactured by the Chicago Pneumatic Tool Co., Chicago, was designed to overcome the objection arising from the intermittent action of ratchet levers in the rotation of the spindle. In the Little Giant, steady uninterrupted revolution of the drill spindle is accomplished by means of a train of gears,

retaining all the advantages of the ratchet and permitting the drill to be used in the same narrow space, within $1\frac{7}{16}$ in. of the end wall or corner. In the Little Giant corner-drill the power of the motor is transmitted to the spindle without vibration, resulting in a steady even pull with minimum wear and tear on the machine itself. In the stub-tooth gears which are employed, the root of the gear tooth is much thicker than in the standard involute tooth. The tooth itself is shorter, hence it has a harder pull. The special alloy-steel used in these gears makes them practically indestructible.

The United States Fuel Administration has issued Bulletin No. 1 on Boiler and Furnace Testing. Copies may be obtained on application to the administrative engineer of the State in which the applicants reside, or to the Conservation Bureau of the United States Fuel Administration at Washington, D. C.

PATTERN AND TOOL PLANT SOUGHT BY LOUISVILLE, KENTUCKY

It is announced by Tampton Aubuchon, general manager, that the Million Dollar Factory Fund of Louisville has appointed a special committee composed of representatives of a number of large manufacturers of tools, dies, wood and metal patterns, with the view to establishing a tool and pattern plant in the Louisville Industrial District.

The need of a local high-class pattern and tool shop is accentuated by the unprecedented growth of fifty-nine metal-working plants in the Louisville Industrial District during the past few years.

The committee has begun negotiations with a number of large tool and pattern concerns and it is believed that the necessary arrangements for the establishment of such a plant in Louisville will be consummated at an early date.

COMMERCIAL PARAGRAPHS

'Centrifugal Pumps' is the title of a handsome 20-page catalogue (Bulletin No. 60) just off the press for the **Byron Jackson Iron Works** of San Francisco. Pumps of many designs, up to the 50-in. type with capacity of 80,000 g.p.m. under 25-ft. head, are described and illustrated. Many pipe connections, shaft couplings, valves, and other useful information is given.

Machinery, supplies, freight-rates, labor, etc., are too high these times for anyone to risk the possibilities of a small fire growing into a serious conflagration. It therefore behooves managers of all industrial plants to have large chemical fire-engines, as they are the most efficient in extinguishing fires. **Arthur R. Bird** of 311 California street, San Francisco, represents and carries a large stock of the well-known Ajax chemical fire-engine.

United Filters Corporation is moving its Eastern works and testing laboratory to its own factory building at 355 Cortland street, Belleville, New Jersey. About November 15 it will move its sales office to 65 Broadway, New York City. Hereafter all samples of material for laboratory tests and all filter parts forwarded for repairs or renewals should be shipped to the Belleville address, as given above. It will be convenient to witness laboratory tests, for the new laboratory can be reached in 40 to 45 minutes from New York.

The entry of a great metal-using concern like the **Magnolia Metal Co.** into the market as a buyer of antimony ores, is an event of importance. Between the consumer and the producer of antimony has stood an army of brokers, and the American miner has found it practically impossible to find a way to market that was not beset with difficulties and discouragements. It is a great boon to be able to deal direct with a large and responsible user of the metal. It should stimulate the development of American antimony mining. The announcement of the Magnolia Metal Co. appears in our advertising columns.

Mining and Scientific Press

Edited by T. A. RICKARD

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Number 22

SAN FRANCISCO, NOVEMBER 30, 1918

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$4 per Year

AN INDEPENDENT WEEKLY PAPER OWNED, EDITED, AND MANAGED BY ENGINEERS

SINCE JUNE 1917 WE HAVE FURNISHED THE

UNITED STATES GOVERNMENT

2,311,797 FEET REMCO PIPE

Camp	Feet
Camp Sevier, S C	4,008
Camp Dodge, Ia	140,151
Camp Humphreys, Va	6,000
March Field, Cal	10,956
Mather Field, Cal	18,502
Army Camp, Texas	6,402
Mare Island Navy Yard, Cal	8,008
Charleston Q M Term S C	111,526
Camp Perry, Ohio	15,917
Camp Abraham Eustis, Va	93,531
Camp Harry J Jones, Ariz	8,305
Marine Training Camp, Va	20,955
Camp Travis, Texas	11,753
Explosives Plant, W Va	16,500
Camp Lee, Va	33,274
Norfolk Q M Terminals, Va	10,148
Camp Shelby, Miss	31,200
Camp Greene, N C	13,100
Fort Caswell, N C	46,614
Camp McArthur, Texas	24,407
Camp Logan, Texas	29,792
Camp Wadsworth, S C	27,483
Camp Sheridan, Ala	25,207
Picric Acid Plant, Brunswick, Ga	
	19,364
Camp Knox, Ky	109,512
Camp McClellan, Ala	38,008
Camp Upton, N Y	22,805
Camp Bragg, N C	48,200
Camp Sherman, Ohio	2,600
Picric Acid Plant, Fisher, Mich	10,000
Camp Grant, Ill	29,100
Camp Columbus, Ga	17,000
U S Naval Training Station, San Francisco	500
U S General Hospital, Azalia, N C	5,680
U S General Hospital, Waynesville, N C	600
Camp Cody, N M	16,010
Camp Wheeler, Ga	9,681
Camp Fremont, Cal	68,310
Camp Merritt, N J	22,920
Camp Gordon, Ga	29,826
Camp Pike, Ark	86,092
Camp Taylor, Ky	23,800
Camp Jackson, S C	63,886
Camp Dix, N J	14,540
Gerstner Field, La	21,871
Camp Johnston, Fla	56,332
Camp Meade, Md	25,022
Embarkation Camp, Va	16,016
Ellington Field, Texas	21,439
Camp Tobin, Texas	11,542
Love Field, Texas	18,408
Camp Devens, Mass	82,328
Camp Kearny, Cal	61,616
Camp Custer, Mich	9,404
Raritan River Ordnance Depot, N J	20,016
Camp Stuart, Va	41,506
Engineer Depot, France	169,414
Ebbetts Field, Ark	9,502
Kelley Fields, Texas	94,697
Brooks Field, Texas	4,288
Pig Point Ordnance Depot, Va	10,034
Coastal Aero Station, Fla	1,000
Curtis Bay Ordnance Depot, Md	12,752
Raleigh Tank School, N C	13,085
Martin Rockwell Loading Plant, Del	48,500
Fort Leavenworth, Kan	40,000
U S Spruce Prod. Corp., Toledo, Ore	12,955
Infantry School of Arms, Ga	55,000
Camp Benning, Ga	4,000
Fort Sill, Oklahoma	400
Camp Oglethorpe, Ga	2,150
Harwoods Mills Development, Va	50,500
Portsmouth Water Development, Va	34,000

45,517,800 GALLONS REMCO TANKS

Camp	Gallons
Camp Devens, Mass	400,000
Camp Taylor, Ky	1,000,000
Camp Upton, N Y	1,050,000
Camp Meade, Md	1,037,000
Camp Pike, Ark	1,800,000
Camp Sherman, Ohio	800,000
Camp Shelby, Miss	1,800,000
Camp Funston, Kan	800,000
Camp Custer, Mich	400,000
Camp Wadsworth, S C	700,000
Camp Wheeler, Ga	500,000
Camp Cody, N M	1,000,000
Camp Sevier, S C	400,000
Camp Shelby, Miss	800,000
Camp McArthur, Texas	500,000
Camp Greene, N C	400,000
Camp Logan, Texas	400,000
Camp Stuart, Va	1,600,000
Camp Johnston, Fla	400,000
Ellington Field, Texas	80,000
Engineer Depot, France	4,428,000
Love Field, Texas	275,000
Fort Caswell, N C	200,000
Pig Point Ord Dep, Va	230,000
Kelley Field No 1, Texas	100,000
Dorr Field No. 2, Fla	200,000
Ebbetts Field, Ark	100,000
Taylor Field, Ala	100,000
Ordnance Depot, Md	800,000
Mt Clemens, Mich	120,000
Camp Tallaferro Fields, Texas No 1 No 2 No 3	300,000
Fort McHenry, Md	200,000
Coastal Aero Sta, Fla	101,000
Call Field, Tex	100,000
Camp San Juan, Porto Rico	400,000
Gen. Hospital No. 3, N. J	200,000
Fort McPherson, Ga	200,000
Mechanical Repair Shop, Md	200,000
Tuberculosis Hospital, N Y	420,000
Chemical Plant No 4, Va	840,000
Park Field, Tenn	100,000
Navy Yard, Pauillac, France	100,000
U S Explosives Plant, Tenn	1,054,300
Queenstown, Ireland	100,000
Guantanamo, Cuba	47,000
Payne Field, Miss	100,000
Souther Field, Ga	100,000
Clearing Hospital, N. Y	200,000
Mills Field, Cal	175,000
March Field, Cal	75,000
U S Explosive Plant, W. Va	800,000
U S Hospital, N C	300,000
Q M Dep, S Schenectady, N Y	400,000
Q M Dep, E Columbus, Ohio	400,000
Q M Dep New Cumb, Pa	40,000
Ordnance Depot, Pa	200,000
Camp Eustis, Va	818,000
Marine Training Camp, Va	1,256,000
Filtration Units, France	1,251,200
Aviation Concentration & Supply Depot, L. I	100,000
Camp Perry, Ohio	300,000
Aerial Gunnery School, Fla	200,000
Camp Jones, Ariz	100,000
Q. M. Term., Charleston, S. C	400,000
Raritan River Ord. Dep., N. J	40,000
Coast Defense, Pensacola, Fla	400,000
Final Testing Field, Dayton, O	100,000
Scituate Proving Grounds, Mass	100,000
Fort Sill, Okla	1,200,000
Fort Keogh, Mont	100,000
Q. M Storage Depot, Mo	40,000
West Point Artillery Camp, Ky	400,000
Camp Jackson, S C	1,000,000
Training Camp, Chemical Warfare Service, N J	100,000
Camp Bureaugard, La	1,000,000
Walter Reed Gen Hospital, Washington D C	400,000
Tank School, Raleigh, N C	500,000
Oriana, Va	400,000
Camp Grant, Ill	400,000
Jefferson Barracks, Mo	200,000
Picric Acid Plant, Mich	100,000
Camp Dix, N J	400,000
U S Shipping Board, Va	200,000
U S Shipping Board, Cal	200,000
Aberdeen Proving Grounds, Md	148,000
Camp Knox, Ky	83,000
Filtration Plant	83,500
Picric Acid Plant, Ga	400,000
Filtration Plant, Ark	125,000
Camp Bowie, Tex	400,000
Brooks Field, Tex	100,000
Camp Dodge, Ia	470,000
Delaware Ord Dep, N J	250,000
Camp Benning, Ga	400,000
Naval Ord Plant, W Va	800,000
Camp Bragg, N C	59,000
Gen. Hospital No 31, Pa	200,000

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Redwood for Durability

REDWOOD MANUFACTURERS CO.
1605 HOBART BLDG.,
SAN FRANCISCO, CAL.

Remco for Mechanical Perfection

Entered at the San Francisco post-office as second-class matter.

Buyers' Guide, Page 42
Advertisers' Index, Page 50

MASSCO ELECTRICAL SUPPLIES

Get this fact clearly in mind—

Massco Service to mine, mill and smelter is a complete Service.

Nothing illustrates this truth better than the Electrical Supply end of Massco Service. For instance, anything in the following list of supplies can be furnished:

Wire	Pole Line Supplies	Transformers
Insulators	St. Ry. Supplies	Meters
Conduit and Fittings	Street Fixtures	Heating Devices
Sockets, Rosettes, Plugs	Tools	Telephones
Snap Switches	Insulation	House Goods
Cutouts and Fuses	Lamps	Fixtures
Knife Switches	Motors	Shades

These are standard goods. Special catalogs, bulletins and prices furnished on request.

Crushers, Pulverizers, Clay Goods, Chemicals, Instruments, etc.

Large stocks carried in Denver, Salt Lake City and El Paso. Marcy Ball Mills—Wilfley Concentrating Tables, Headquarters for Mine, Mill and Smelter Equipment.

The Mine & Smelter Supply Company

A Service Station Within Reach of You

Denver **Salt Lake City** **El Paso**

New York Office: 42 Broadway

The Massco Giant *Typifying Worldwide Service*

RESTRICTIONS imposed on dealings in platinum have been cancelled, likewise those governing the domestic use of gold and silver for industrial purposes. We hope that the exportation of gold will be permitted shortly, because that would tend to promote the appreciation of the standard metal, thereby lowering the prices of commodities.

HOLLAND has been invaded by the Enemy in person and is beginning to feel inhospitable. Where is the Kaiser, dethroned and disgraced, welcome? We feel sorry for Holland, and also for Switzerland, which is being filled with disreputable people, from international spies to princes and grand dukes, so that the stage set among the Alps looks like a cheap cinema or an opera bouffe.

LEAD producers have been requested, by the Lead Committee of the War Industries Board, to curtail production, it being recognized that the present price of the metal cannot be maintained unless this be done. The Government has cancelled its orders for December and forward. We note that our New York correspondent refers to the unexpected stability of the zinc market.

COMPENSATION for the heart-aches of the four tragic years has come to the Allied peoples in the thrilling news of recent days. The triumphant entry of King Albert and his Queen into Brussels, the unimpeded march of the French armies under Marshals Petain and Castelnau into Metz and Strassburg, the enthusiastic reception given to General Pershing and the American troops in Luxemburg, the landing of British troops on the Gallipoli peninsula, and greatest spectacle of all, the passing of the German fleet into ignominous captivity, these are scenes that would have beggared our imagination only a month ago.

HALOS are sticky. Uneasy is the seat that fills the swivel-chair. We detect an unwillingness on the part of sundry gentlemen, recently rendered fussily important, to retire into positions of greater ease and less responsibility. We are being told, by some of them, that the era of reconstruction after the War involves problems as weighty, if not more weighty than, those that they have been helping to solve. This sounds impressive, and it is true in a measure, but we suspect the desire to remain in the lime-light, or on the movie-film, on the part of sundry minor dollar-per-annum officials whose usefulness as public regulators has been terminated by the cessation of hostilities in Europe.

HENRY FORD, it is announced, is to be an editor, having become satisfied that he can be more useful in that capacity than as a legislator, for which duty he was rejected by the voters, or as a manufacturer, in which rôle he has achieved remarkable success. Apparently he believes that the work of an editor requires no special training, but a large measure of self-confidence; having failed as a politician, he thinks that the arts of manufacture, especially those of assembling the parts of a machine in the making of vehicles of transport, will suffice to ensure his effectiveness as an editor, the Greek name for which, by the way, means one that assembles or brings together. We marvel at Mr. Ford's impudence. He should call his paper 'The Jitney'.

BY inadvertence we omitted last week to make mention of the visit paid by Mr. Sidney J. Jennings, as President of the Institute, to the local section in San Francisco. This pleasant event, on November 13, was marked by an interesting address from Mr. Jennings, followed by a discussion, to which he also contributed most agreeably. Owing to the enforced wearing of masks the audience looked like a gang of conspirators, but even that untoward restriction on good fellowship failed to spoil the occasion. Unquestionably such visits of the President of the year to the local sections—now almost an established custom, for which we owe thanks to Mr. Philip N. Moore—serve an excellent purpose in keeping the New York headquarters in proper touch with the members residing at the more distant centres of mining engineering.

CAPTAIN MAHAN would have loved to have seen the day when the German fleet under its own steam had to go to a British port in order to complete its surrender without firing a shot. When the German armies were defeated the sailors of the German navy mutinied rather than follow the example of Cervera at Santiago in 1898; they did not mutiny when ordered to kill women and children. It is said that when the German dele-

gates to the first conference for an armistice, on November 8, protested against the surrender of the fleet without the chance of battle, Sir Rosslyn Wemyss, representing the British Admiralty, said: "You had only to come out." Instead, they surrendered. After all, Jutland proved to be a Trafalgar. The Kaiser's wild boasting has become a pathetic joke. On November 21 the German fleet of 71 vessels crossed the North Sea to be received by the Grand Fleet, under Sir David Beatty, assisted by an American and a French squadron. The surrendered vessels of the Enemy passed down a lane of 400 splendid warships in two lines 15 miles long into the Firth of Forth, while their crews were sent home on transports. Even more do we rejoice in the picture of the murderous U-boats arriving off the Scottish coast to be interned and presumably to be destroyed. We do not envy their commanders and crews, who feared the resentment of the British and found themselves treated with contemptuous courtesy. They had put up a dirty fight. In order to avoid the identification of submarines that had been concerned in acts of peculiarly vile destructiveness their numbers had been deleted. The German naval flag has been pulled down and we are revenged on submarine piracy. As to the British fleet, it has been praised appropriately, just before the armistice, by our Admiral Sims, who said, that "it is the supreme and saving fact in the War." He stated also: "But for the Fleet, America, for all her wealth of men and means, would have stood impotent. It is the Fleet which after four years and more of grilling inaction holds unimpaired its high spirit and morale that has made all else in this war possible and which assures to us ultimate triumph. I say, all honor to the Fleet, which has performed its great service without the incentive of direct achievement or the stimulus of positive action." There has been both action and achievement, but the long spells of inaction has been hard to bear. The story is summarized in Admiral Beatty's signal after the surrender: "The German flag is to be hauled down at 3:57 and is not to be hoisted again without permission." Von Tirpitz is a refugee in Switzerland.

Thanksgiving

Never since the founding of these United States has there been such a Thanksgiving Day as November 28, 1918. By the time this reaches our readers the date will have passed, but the feeling of gratitude will have remained. After the Pilgrim Fathers landed on the bleak coast of New England they underwent many hardships and privations, but they persisted courageously in their pioneer work until they were rewarded by favorable seasons and happier days. Then it was that they founded this national holiday as a day of festival after the harvest and of homage to a beneficent providence. Thanksgiving Day has become to the American people much as Christmas Day to those in Europe. This year it is steeped with sentiment, national and humane. We rejoice at the ending of the War, we celebrate the vindication of Right, the triumph of democracy over military autocracy, the prospect of international peace, but most of all we thank God that America has vindicated her manhood. There is so much for which to be deeply thankful that the mind flutters from one point to the other like a butterfly over a parterre of flowers. To us it seems that most of all we ought to rejoice that our country did not stay out of the War and that her delay in entering did not make her too late to assist the defenders of liberty on whom the German onslaught first fell. We should forbear to boast in the presence of the millions of the noble dead of other nations that were sacrificed for our cause before we joined the survivors in bringing the contest to a victorious conclusion, but we may be happy in the thought that once we took a part we did it wholeheartedly and effectively. We have cause to be unreservedly glad that, when the call to arms was sounded, the diverse elements in our population responded to the national summons and that American patriotism proved itself superior to the distinctions of racial origin. We had the chance to prove an idealism that sought no material gain, a humanity above the dollars, a democracy loftier than diplomacy, and we have used these chances gloriously. Of defects and deficiencies we are conscious, of fallings short we are aware, but in the sum total of achievement we may rest content. The one government in the world that offered a serious challenge to democracy has been overthrown by its own people; civilization has conquered the most highly organized brute force that ever threatened human liberties; the laws of freedom have been vindicated to the hilt. We are proud of the valor and the conduct of our soldiers and sailors, we are grateful for the relatively small sacrifice of life that has been exacted of us, and for the enriching experience that has been granted to our sons in participating so honorably in the great events overseas. We thank God for a bountiful harvest, for our national prosperity amid world devastation, for the end of the fighting and the assurance of peace, and, last but not least, for the passing of the black plague.

The Cost of the War

The nations are counting their losses; for example, an authoritative estimate places the German casualties at 6,070,000, of whom 1,580,000 were killed and at least 1,500,000 permanently crippled. The British casualties have been announced officially as 3,049,991, of whom 685,665 were killed, and probably about 500,000 were crippled for life. The French casualties have not been published at any time since the beginning of the War, but they are likely to be not less than those of Great Britain. Altogether it may be estimated that Germany's losses in battle were about equal to those of her two chief adversaries and that the War on all its fronts involved the sacrifice of 6,000,000 lives, together with the physical wrecking of half as many more. It will be noted that most newspaper estimates are in excess of the official figures, because many names have appeared more than once in the casualty lists and the reports of losses

in battle are habitually magnified. However, to say that does not signify any desire to belittle the terrible toll exacted by the scientific and organized murder that we have been compelled to witness for more than four long years until our sensibility to horror has been calloused. For instance, our own casualties are so small, namely, 236,117, of whom 36,154 were killed, that they hardly count in the mortuary record of the War, yet the loss of those dear to us gives a frightful significance even to a total so small when compared with those of the European powers. Turning to the loss in money, it is estimated that the War has cost Great Britain already 40 billions of dollars, of which 8 billions have been loaned to her Allies and one billion to her overseas Dominions; so that the total cost before demobilization is completed will probably reach the round sum of 50 billion dollars. The cost to the German government has been 45 billions and to the French 32 billions. The United States and Austria-Hungary are estimated each to have spent 21 billions, Russia 30, and Italy 12. Adding the costs incurred by the smaller belligerents the grand total of expenditure amounts, in round figures, to 200 billions. The United States has loaned $7,732,000,000 to her Allies; during the month ended November 10 she spent $1,542,056,613. These are colossal figures but they have little significance until compared with the incomes of the nations mentioned. For example, the income of the United States is estimated at 50 billions and that of Great Britain at 17 billions per annum. The annual savings of the people of Germany and England were estimated at somewhere between 2 and 2½ billions each before the War. The loss of a year's income is unpleasant, but not serious; the loss of two years income is serious, but not fatal. Germany is bankrupt; France and Italy have been grievously crippled; Great Britain has been seriously impoverished; but the wealth of the United States has only been nicked. Apart, however, from the losses incurred by the governments of the belligerent nations, we must consider the drain made upon the financial resources of individual citizens. This has been relatively small in our country, for whereas many have suffered, voluntarily and involuntarily, others have made money, and a great deal of it, so that the citizens of the United States as a whole have little to say in the face of the sacrifice and privations incurred by the peoples that were at war for more than twice as long, particularly those whose soil became the theatre of warfare. The financial contributions made by the individual Englishman, Frenchman, or German, together with the taxation to which he responded patriotically, must represent an enormous addition to the cost of the War. It has been stated that the average British business man has been contributing three-quarters of his income in taxes, rates, and subscriptions. Thousands have let their businesses go to ruin and thousands have sacrificed their professional careers. The monetary losses involved, outside those of the governments of the European nations, stagger the imagination. The loss in life and money, in human comfort and happiness, has been appalling, and yet, now that the price has been paid, it is at least a sad satisfaction to know that right has triumphed completely and that the tyranny of militarism has been smashed utterly. The losses of our gallant Allies are great, so great as to make ours seem small, but they and we have *won!* Think what it must mean to an intelligent German or Austrian to realize how much his country and people have lost in money and life *in vain*! The generations to come in Central Europe will curse them for their hideous failure; they may realize that even for them it was best that their conspiracy of conquest should fail. On the other hand, whereas the manhood of this generation in Belgium, England, France, Italy, the United States, and the other Allied nations, has given its best in sacrifice, and mourns its loss at this moment of victorious exaltation, yet it knows that its purpose has been accomplished and that generations unborn will hallow its deeds in grateful remembrance.

Minerals Separation and the Gag

Our readers will have learned through the daily press that the Federal Trade Commission has issued a formal complaint against the various Minerals Separation companies and their associates, Beer, Sondheimer & Company, Benno Elkan, Otto Frohnknecht, and Harry Falck, all of New York, the charge being that they are combined in affiliation with German interests and that they are using unfair methods of competition aiming to monopolize the industry of separating minerals by flotation in the United States. They are further charged with attempts to prevent independent concerns from making or selling any apparatus used in flotation that is not covered by their own patents and with attempting to prevent mining companies and mine operators from using such independent apparatus. They are charged with discriminating as to the royalties they impose in an effort to discipline or punish those unfriendly to them, and with making false claims of rights in excess of those granted to them by patent. They are charged with threatening to prosecute those that are not docile to their purpose and with intimidating others by withholding licenses to use their processes and apparatus when it suits their monopolistic campaign. They are charged under the Clayton anti-trust act with making exclusive selling contracts, fixing prices, and making rebates on condition that the purchasers shall not deal with independent competitors. They are cited to appear before the Commission at Washington on December 30.

Here is the place to record the attempt of Minerals Separation to dictate to the Mining and Scientific Press. Late in July 1915 we interviewed Mr. Charles Butters on metallurgical matters, including flotation. The interview was ready for the printer when we received a call from Mr. E. H. Nutter, manager in San Francisco for the Minerals Separation company. Mr. Nutter, of course, was well known to us personally as an honorable member of the mining profession and in years gone-by he had been a valued contributor to our columns. He asked whether an article by Mr. Butters

was in our possession and thereupon stated that he had "to raise the red flag", not of Bolshevism, but of warning, proceeding to explain that he objected to the publication of the article because it did not suit the policy of his company, which was to discourage either the publication of information concerning the flotation process or the further application of the process until such time as the Supreme Court gave exclusive rights to his company. We suggested: "Until you get a cinch?", to which he acquiesced smilingly. Fortunately, Mr. Frank H. Probert, of the University of California, happens to have been present throughout the interview. Mr. Nutter insisted that his company had contracts with licensees whereby anything that might be discovered became the property of Minerals Separation and nothing could be published without their permission. Mr. Butters was a licensee. Some of the data, he said, given in the Butters interview touched on points involved in their applications for patent and as the MINING AND SCIENTIFIC PRESS was widely read in foreign countries this might lead to some quick-witted technician obtaining a patent on these points, or the article might lead to experimentation that would serve as a basis for new and competitive patents. A copy of the article was given to Mr. Nutter, as a matter of courtesy, there being no hurry to publish it, but he was informed that the article was the property of this paper, that nobody had the right to veto publication, not even the author, except as a polite concession, and that Mr. Nutter or Minerals Separation had no more right to interfere than the first man in the street, but as the Editor's aim was to be as useful to as many as possible and injurious to as few as possible Mr. Nutter could —as he wished—forward it to his chief, Dr. Gregory, at New York. The latter, in due course, sent a release, but Mr. Nutter persisted in his veto, whereupon we warned him, as a member of the profession, that he was treading upon dangerous ground. On being pressed to give a reason for his action, he said that Mr. Butters had quoted experiments on the use of chloridizing roasting for flotation concentrate previous to cyanidation, and he did not want this fact published because he, forsooth, thought of patenting this idea; whereat we exclaimed against anything so preposterous, instancing experiments we ourselves had made on the chloridizing roasting of concentrate in Arizona 23 years previously. We urged him, in a friendly way, to drop his impossible 'request' and at least to send a night-letter to Dr. Gregory before committing himself to an act that would inevitably start a bitter fight with us. He telegraphed to New York and a few days later he telephoned to say that he withdrew his objections. The article was published, in our issue of August 21, 1915, exactly as it had been written before Mr. Nutter undertook the duty of censor. We realized how narrow was the policy and how mean was the spirit of the Minerals Separation people and determined then to publish as much useful information on flotation as we could obtain. Within the following two years we published more information on the flotation process than had been published in all the technical papers in this country or abroad during the ten years preceding; in 1916, and again in 1917, we published a book on the subject. That was the sequel to the attempt of Minerals Separation to gag the MINING AND SCIENTIFIC PRESS.

The Price of Copper

The agreement made between the War Industries Board and the representatives of the copper producers to maintain the present rate of production and to continue both the existing price for the metal and the current rate of wages for the remainder of this year is of good augury. It postpones any immediate change in the status of the copper-mining industry. Announcement is made that one of the Allied governments has asked for the delivery of 200,000 tons, or 448 million pounds, of American copper. This is about equal in amount to the stock of copper in transit and unsold in this country at the present time. Domestic consumption, it is said at Washington, will require a good deal of copper to correct the shortage created by the demands of War. The resumption of automobile manufacture is a favorable factor. Reconstruction abroad should furnish a market for an enormous quantity of the metal, even after allowing for salvage from the munitions that will be scrapped as soon as peace is definitely concluded. Germany must be in urgent need of copper, in consequence of the collection of the metal from roofs, bells, utensils, and even electric equipment, during the period of the War. All this appears encouraging to the miner; but there is the other phase of the subject to be considered. The absorption of 90% of the world's output of copper by war necessities is a fact to check undue optimism. In September our exports of copper aggregated 71,220,800 pounds, as against a maximum this year of 81,058,000 pounds in January and a minimum of 42,300,000 in August. Such statistics are interesting, but the future prosperity of copper mining depends, it seems to us, mainly on the solving of the labor problem. The cost of producing copper has more than doubled during the last two years, largely owing to the higher wages paid at the mines, mills, and smelters. Of the total cost of production 60% is recorded on the payrolls of the companies. Will that be reduced soon? Will the deflation of the expenditure for labor be effected reasonably and amicably, or must it be done at the intolerable toll of disorder and riot? Here, it would seem, is room for the proper use of Government paternalism and Federal control of industry, to which mining has submitted cheerfully during the War and to which it is entitled now to turn for protection. Just as the mining companies acquiesced in the raising of the wage-scale when copper increased in its selling price, so now they have a right to expect that their employees, under Government tutelage, will acquiesce in the reduction of wages when the price falls, in obedience to economic law. This is going to be an excellent test of democratic government and we are not without hope of seeing an equitable result and a peaceful solution induced by the pressure of public opinion.

Mining in Alaska

The Editor:

Sir—The letter from your Editorial Department to our former inspector, William Maloney, was turned over to this office for answer and in such answer we must admit that the reports you have received regarding the reduced output of gold of Alaska and the Yukon Territory are too true. Alaska has been hard hit by the War and war conditions and the result has been that, owing to those conditions, many hundreds—yes thousands—of people have left the northern country for the reason that employment can be more easily obtained elsewhere at present. Owing to the increased cost of both labor and material, also supplies, many low-grade mines have suspended operations for the present and until conditions undergo a change. "Distant fields look green," and many who have gone out from the north now realize that they had better remained here, and many are returning and more will return as soon as they can arrange to do so. All the large quartz mines, including Treadwell, Alaska Juneau, Alaska Gastineau, Kennecott, Latouche, and Chichagof, are still operating but with reduced forces. For example, the Alaska Gastineau is working but 125 underground where 450 were formerly and in normal times employed.

Every mail brings to this department many letters of inquiry for positions from people who are desirous of coming north, and indications are that the close of the War will witness the greatest rush this country has seen since the Klondike discovery.

E. J. White,
Chief Alaska Bureau of Publicity.

Juneau, November 2.

Why Not Domestic Ores First?

The Editor:

Sir—As you were kind enough to find space for a previous article from me in regard to 'Prospecting Conditions in California Today', I wish you would insert these lines in your discussion columns for debate on a vital issue of the present time. I refer to the position of the producers of the so-called war metals, manganese, chrome, tungsten, vanadium, etc. As I am one of the many producing manganese, I would like to discuss the subject from the manganese producer's standpoint. During the present war there has been an enormous demand for manganese and the Government, cut off from foreign supplies, appealed to the miner and prospector to fill the want. Under this stimulus patriotic people have invested their money and opened up numerous deposits throughout the United States. It means business employment and taxes for the Government. Is this all to be a wasted energy as soon as peace is declared? Are these producers to be at the mercy of ships laden with ore as ballast from India, Brazil, etc? Is not this a system of dumping that is wholly uncalled for, or does the steel trust still maintain its lead in the Government? Why not domestic ores first? We cry, "See America first," "America first, last, and always"; then let us have fair play for those that in the time of stress and trouble gave freely, worked by day and by night, and produced the necessary raw material to beat the Hun! Why not a tariff to protect the American producer from cheaply mined foreign ores? If the Government fixed the present schedule and the steel plants made enormous profits by it, then surely they can afford to pay a price consistent with the state of things in time of peace. The same applies to chrome and other ores. So if any of your readers have a glimmer of light upon the position of the above-mentioned producers, why not 'open the ball' through your discussion columns. I, for one, would welcome it.

Leonard G. Blakemore.

Volcano, California, November 14.

War Controls

The duration and conclusion of the chief emergency activities of the Government are as follows:

Control of railroads, 21 months.

Control of telegraph and telephone lines, during the War.

Food and fuel control, end of War.

Espionage Act, end of the War.

War Trade Board and export control, end of the War.

War Finance Corporation, six months after the War, with further time for liquidating.

Capital Issues Committee, six months after the War.

Re-organization of Government bureaus under the Overman law, six months after the War.

Alien Property Custodian, end of the War, with extension of time for certain duties.

Government operation of ships, five years after the War.

Aircraft Board, six months after the War.

Agricultural stimulation, end of present emergency.

Labor employment, during present emergency.

Minerals stimulation, as soon as possible after proclamation of peace.

Federal Trade Commission v. Minerals Separation

Declaring it has reason to believe six concerns with headquarters at London, New York, and in Germany are united in a metal combination in affiliation with the great German metal interests, and are practising unfair and destructive methods of competition in the American market aimed at monopolizing the American minerals separation industry, the Federal Trade Commission today issued formal complaint against them and three of their agents. The concerns or persons named in the complaint are:

Minerals Separation, Ltd., Minerals Separation American Syndicate, Ltd., Minerals Separation American Syndicate (1913), Ltd., all of London; Beer, Sondheimer & Company, of Frankfort-on-the-Main, Germany; and Beer, Sondheimer & Company, Inc., and Minerals Separation North American Corporation, New York City; and Benno Elken, Otto Frohnknecht, and Harry Falck, of New York City.

These concerns are charged with enforcing agreements "with the intent, purpose, and effect of stifling and suppressing competition" by which they undertake to prevent independent concerns from making, selling, or leasing any apparatus, processes, paraphernalia, supplies, data, etc., used in the concentration and separation of ores, which are not covered by patent-rights controlled by the combination. They are also charged with attempting to prevent mine operators, metallurgists, engineers, and others from using any such independent commodities except with the combination's permission; and with extorting exorbitant commissions and royalties from both independent concerns and from mine owners, metallurgists, and engineers, and with compelling these latter to surrender to them all inventions which they might make in respect to apparatus for the concentration or separation of ores.

They are further charged with:

Discriminating as to royalties exacted from mine operators, between favored operators and operators whom they desire to "discipline, punish, and make examples of"; and with discriminating as to commissions exacted from independent concerns, between favored concerns and concerns whom they desire to "discipline, punish, and make examples of";

Falsely and maliciously disparaging independent commodities, independent concerns and mine operators, metallurgists, and engineers who prefer to use such independent commodities or who deal with such independent concerns;

Falsely and maliciously claiming and asserting exclusive rights, under patents and otherwise, in excess of rights actually possessed, in respect to apparatus, paraphernalia, processes, supplies, data, etc., used in the separation and concentration of ores;

Maliciously threatening to prosecute patent infringement suits against independent concerns, mine operators, metallurgists, engineers, and others for manufacturing, selling, leasing, licensing, and using independent commodities in respect to which they falsely and maliciously claim exclusive rights;

Intimidating and coercing mine operators, metallurgists, engineers, and others to refrain from using independent commodities by withholding or threatening to withhold licenses to use apparatus, processes, etc., controlled by them.

They are further charged under the Clayton anti-trust act with making exclusive purchase selling contracts, fixing prices, rebates, or discounts on the condition the purchasers shall not deal in or use the commodities of independent competitors.

The concerns and individuals are cited to appear before the Commission in Washington on December 30, 1918.

Platinum Released

On November 14 an important step toward a return to pre-war conditions in certain industries was taken by Van H. Manning, Director of the Bureau of Mines, in modifying the restrictions recently placed on the manufacture and sale of fireworks and of chemicals used in the manufacture of explosives, and on the use of platinum, iridium, and palladium in the manufacture of jewelry and for dental and other non-military purposes. Under the order as modified, licenses will no longer be required in connection with the handling of fireworks or the precious metals named. Many of the numerous chemical elements entering into the manufacture of explosives are used constantly for other commercial purposes, and under the new order no restrictions will obtain on the handling of these chemicals when not used in the manufacture of explosives. Licenses are still required for the handling of all such ingredients when intended to be used in explosives manufacture, however. The explosives regulation act was passed by Congress in October 1917 with the aim of putting a stop to the numerous incendiary explosions and fires occurring at war munitions plants and other industrial establishments. Under its terms, no one might sell, store, or use explosives or ingredients entering into their manufacture without first obtaining a license from the Director of the Bureau of Mines. The restrictions with regard to platinum, iridium, and palladium were added some months later as a means of conserving the nation's limited supplies of these metals, which were essential to the manufacture of explosives and for other war needs, but which were being extensively used in the manufacture of jewelry and for other non-essential purposes.

GOLD AND SILVER CONTENTS of the high-grade ore and ordinary concentrate produced by the Utah Copper Co. during the third quarter of 1918 was valued at $408,594. There was 3,412,700 tons of 1.2% ore dressed, so approximately the precious-metal value was 12 cents per ton.

The Utah Copper Enterprise—VI

The Mills

By T. A. RICKARD

INTRODUCTION. As soon as the mine passed from the ownership of Colonel Wall to the control of the Utah Copper Company in 1903, the company started to build a concentrator having a capacity of 300 tons at Copperton, 1½ miles below Bingham and 2 miles below the mine itself. The original plant was equipped with one No. 6 and one No. 4 Gates gyratory crushers, one coarse trommel-screen, two pairs of 26 by 15-in. and two pairs of 36 by 15-in. rolls, four fine trommel-screens, four Trent, one Janney, and one Waddell 6-ft. Chilean mills, six 3-spigot hydraulic classifiers, six 3-compartment Harz jigs, 34 Frue and 18 Johnston vanners, 48 Wilfley, two Card, and two Overstrom tables. The flow-sheet of the above equipment, as originally installed, is shown in Fig. 1.

The flow-sheet in this mill was changed from time to time (see Fig. 2), and it was on the information gained at this plant that the design of the later mill was based.

The Copperton mill started to work in August 1904. It made a 25% concentrate on a 2% ore, the recovery being slightly under 70%. The capacity was increased gradually to 1000 tons per day; meanwhile designs were

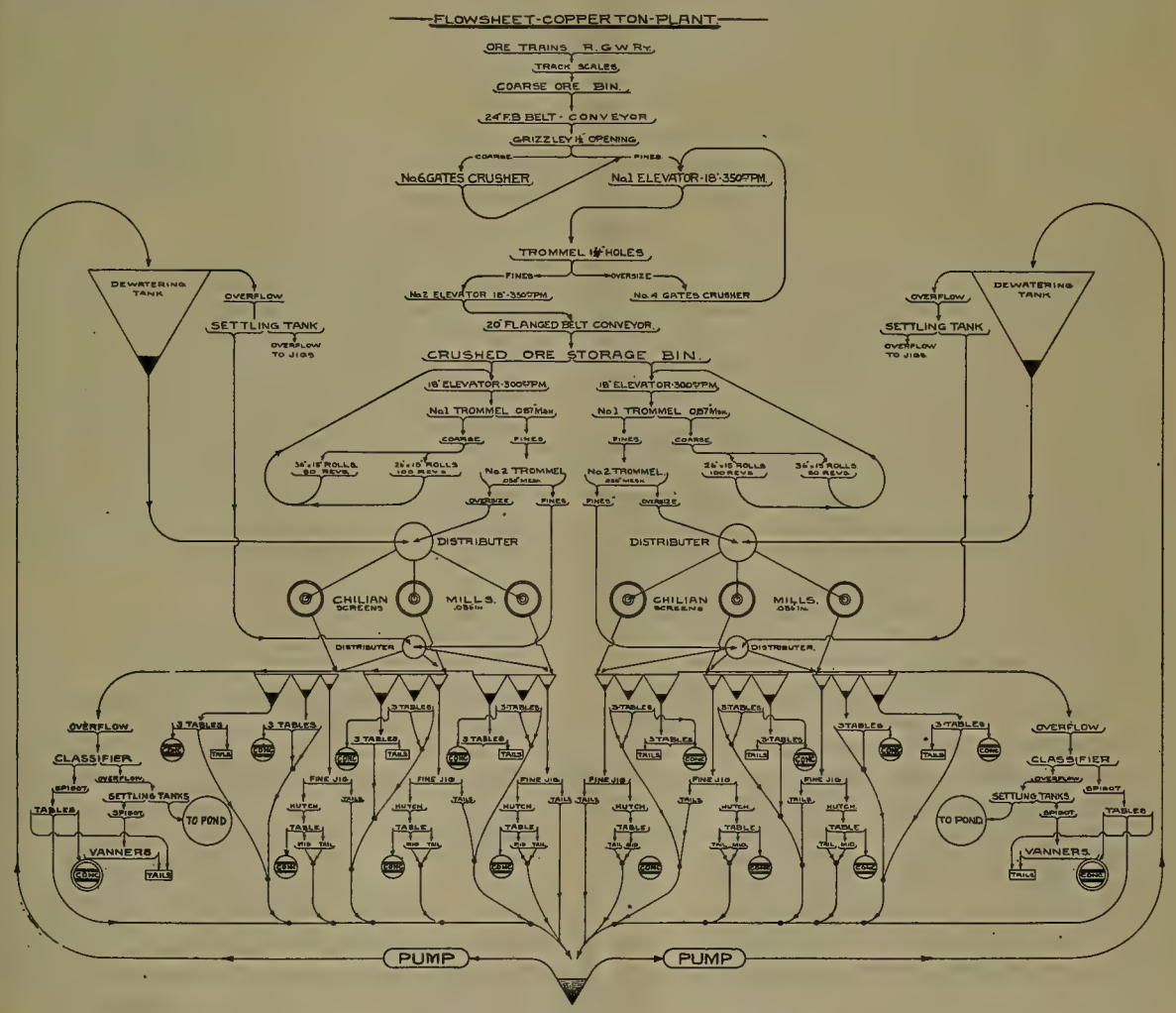


FIG. 1. THE FIRST FLOW-SHEET OF THE COPPERTON MILL

prepared for a larger mill, to be erected at Garfield, near the Lake, four miles east of the smelter belonging to the American Smelting & Refining Co. In 1905 the foundations for a plant of 3000 tons capacity were laid at Garfield, but legal difficulties with Colonel Wall delayed the building of this new mill, and in the interval the development of the mine progressed so favorably that it was decided to make this plant, called the Magna, one of 6000 tons capacity. The first section—500 tons—started to work in June 1907, and the entire mill was in operation by November 1908. By 1908 the mine had been so opened up as to furnish ample ore, but the lack of railroad facilities prevented a regular and adequate supply of ore, so that the mill treated only 77% of its rated capacity and only 55% of what it showed itself capable of treating when fully equipped. At this period the company had constructed and started to operate a power plant at Magna sufficient for the entire enterprise. This proved a great economy and advantage in many ways. The springs at Pleasant Green, near Magna, which the company had purchased from Colonel Wall and others, produced ample water for the tonnage then being treated.

These springs yield, with continuous pumping, 12,500 gal. per minute. The No. 1 pump-station is at the springs, which, to be precise, are half a mile north of Pleasant Green and close to the old Magna steam-power plant. The water is pumped to the Magna reservoir against a head of 225 ft., and to the Arthur reservoir against a head of 325 ft. During recent years the bulk of the water used in the two mills has come from the Jordan river through the Utah & Salt Lake canal, the point of diversion from the river being 5.7 miles north of Utah lake. The No. 2 pumping-station, which is at the lower end of the canal, supplies the Magna reservoir against a head of 30 ft., and from this reservoir the water is pumped to that of the Arthur plant against a head of 100 ft. The Utah Copper Company secured a right-of-way through the canal from its owners, together with the right to enlarge the canal; this work has been in hand for several years and was completed during the current year. The amount of water received through the canal varies with the seasons; any shortage is rectified by pumping from the springs. As nearly as can be determined, none of the tailing-water rejoins the source of the springs, owing probably to the fact that the fine silt in the tailing has sealed the ground. The water from the tailing-dump flows into a large settling-pond and is returned as required to the pump-sump through artificial channels. On average the milling plants use 1440 gal. per ton of ore treated. The average cost of pumping is 8.09 mills per 1000 gallons. In 1910 the company acquired the property of its neighbor, the Boston Consolidated Co.; this included not only the ore-bearing ground adjoining its own mine at Bingham, but also the Arthur mill, about a mile west from the Magna, at Garfield. The Arthur mill, of 3000 tons capacity, was designed by A. J. Bettles in 1905, and was noteworthy for including 312 Nissen stamps in its original equipment. I like to mention this fact because Peter N. Nissen has proved himself much more than a good mill-engineer. A Canadian by birth, he enlisted in the British army in October 1914 and has distinguished himself so greatly by efficiency and gallantry that he is now a D. S. O. and a Lieutenant-Colonel. The Copperton mill was closed-down on August 1, 1910, and most of its equipment of machinery was removed to the Arthur plant. In the following August the Bingham & Garfield railroad, connecting the mine to the mills, was completed by a company controlled by the Utah Copper Co. and by the end of 1912 the two big mills were in a position to treat 21,000 tons of ore per diem.

The Arthur and Magna mills were originally intended for the treatment of 3000 and 6000 tons respectively. They are now treating 16,000 and 20,000 tons. During the third quarter of 1917 they treated a total of 3,439,400 tons, or an average of 37,385 tons per diem.

These two mills stand at the foot of the Oquirrh range, facing the plain from which the Lake has retired. In the mist of morning, as I first viewed the scene, it was easy to imagine that the waters still overspread the plain, which looked like an angry sea, the streaks of saline sand fringing the stretches of marsh like the white crests of green waves.

As the two mills are much alike, except in so far as flotation forms a feature of the Arthur plant, I shall describe only the latter.

Crushing Plant. The ore arrives from the mine in trains of 40 cars. These are of the gondola type, made of steel and emptying at the bottom; on average they hold 68.15 tons wet or 63.82 tons dry. The moisture therefore is 6.35%. The ore is discharged into a primary storage-bin of 10,000 tons capacity, on the top of which grizzley-bars are placed horizontally 12 inches apart. Any pieces too large to pass are broken with sledge-hammers. Below these grizzlies are others set at an angle of 40°, the bars being made of specially rolled steel $2\frac{3}{8}$ in. apart. The oversize passes into pockets underneath, and is drawn by steel apron-feeders 48 in. wide onto a steel-pan conveyor 48 in. wide; this carries it to two No. 8 McCully gyratory crushers, each of which serves a unit, but is supplemented by a spare crusher of the same kind, available for either unit whenever required.

My description will now be confined to one of the two units into which the crushing plant is divided. The undersize from the last-mentioned grizzley drops into pockets, and is drawn from them by steel-apron feeders, 54 in. wide, onto a rubber-belt conveyor, 42 in. wide, that delivers to the first sizing-screen set at 42°, the apertures of which are varied from one to three inches by changing the screen, according to the moisture in the ore. The undersize from the screen is carried by a rubber-belt conveyor (No. 1), 36 in. wide, to the storage-bins. The oversize from the screen joins the product from the crusher, and is conveyed to a belt-bucket elevator (A) that lifts and discharges upon a second screen having apertures that are regulated in the same way as those previously mentioned, that is, in accordance with the

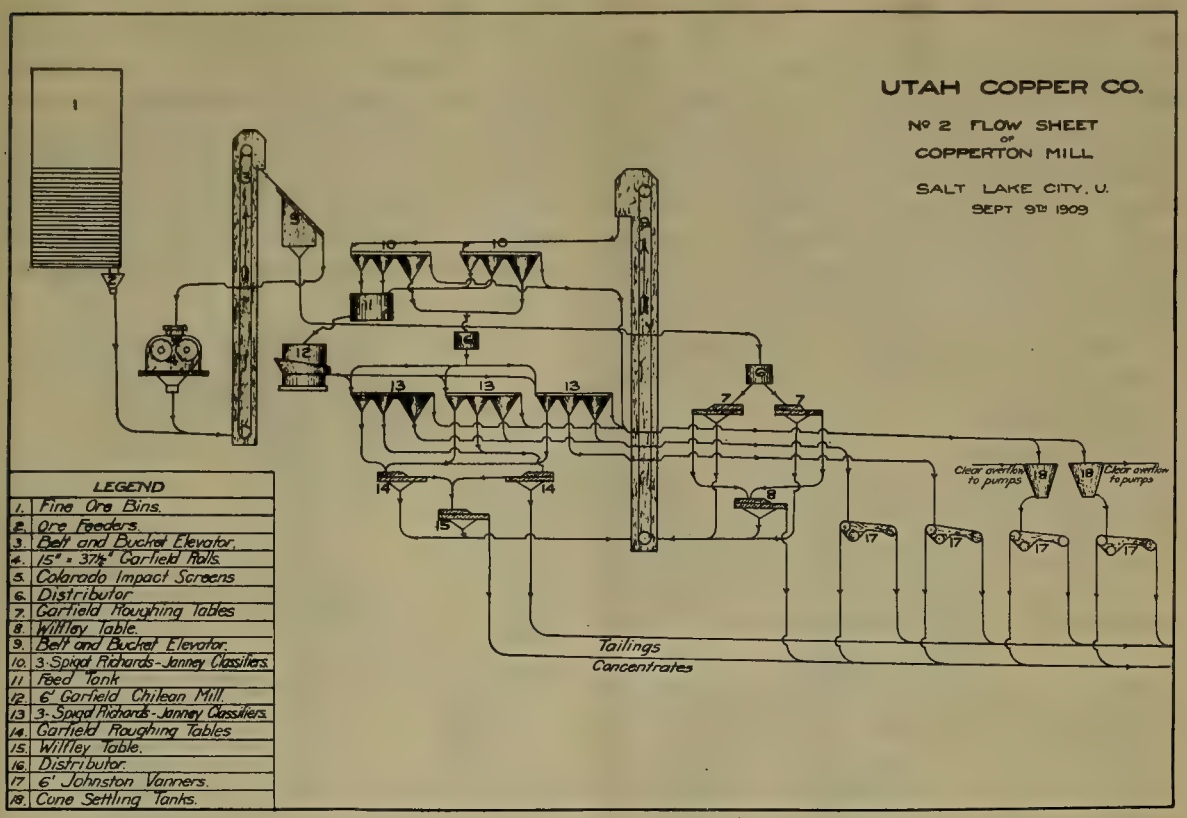


FIG. 2. THE SECOND FLOW-SHEET OF THE COPPERTON MILL

moisture. The undersize is conveyed to the storage-bins by rubber-belt conveyor No. 1, while the oversize passes to 72 by 20-in. rolls operated at 100 r.p.m. This pair of rolls is equipped with fly-wheel pulleys, the larger weighing 18 tons and the smaller 5 tons. The product discharges directly to a third wire-mesh screen set at 40°, the apertures ranging from 1 to 1½ in., according to the moisture, which varies from 5 to 13%. The undersize is carried to the conveyor that serves the preceding screens, while the oversize goes to an elevator (B), which takes it to a fourth set of similar screens. The undersize from these goes by a conveyor (No. 1) to the storage-bins, while the oversize is reduced in a second pair of 72 by 20-in. rolls operated at the same speed as the pair previously mentioned. The product of these rolls falls upon a fifth wire-screen set like the others at 40°, with apertures varying from 1 to 1½ in. The undersize goes to the storage-bins, while the oversize passes to the elevator B, which puts this material in a closed circuit with the second pair of rolls.

Already work has been started to re-model this plant in order to overcome the difficulties due to snow and ice. For three months in the winter a loss of capacity equal to 25% is caused by frost in two ways:

(1) The ore freezes in the railroad-cars, making it difficult to unload. This trouble will be overcome by the use of a car-tipple, made by the Wellman-Seaver-Morgan company, and able to overturn a car at an angle of 70°.

(2) The ore freezes in the primary storage-bins. This will be remedied by conveying the ore directly from the primary crushing plant to the secondary crushing plant without any interval of rest, so that the ore will be kept constantly in motion.

(3) The ore at the mine appears to break more coarsely in winter than in summer, causing delays in unloading. There follows an excessive breaking of ore by hand in order to admit it through the first grizzley, the one with bars 12 in. apart. This is to be overcome by the use of a No. 27 Allis-Chalmers Gates gyratory crusher, so that the new plant will include the tipple, the new gyratory, and two 60-in. rubber-belt conveyors.

(4) In addition, two pairs of 72 by 20-in. rolls will be placed in the secondary crushing plant, the idea being to avoid the use of elevators to obtain a fine reduction, namely, a ½-in. screen-aperture during the whole year, as against a 1-in. aperture in use in the summer and a 1½-in. during the winter. (See Fig. 5.)

The secondary bins receiving the product of the crushing plant have a storage capacity of 12,900 tons. Standing at the top of them the visitor may think for a moment that he has a general view of the mill, but he discovers later that he can only see a fraction of the plant, which extends for 1750 ft., as measured from the railroad-track on which the crude ore arrives to the railroad-track on which the finished product is removed to the smelter. However, one does see the floor below, on which

are the classifiers. By leaning over the rail of the ore-bin floor, one can see the Chilean mills at work, and in front of them, under the classifier-floor, are the tanks from which the Chilean mills are fed. The rest of the picture consists of suggestions of further mechanisms with which closer acquaintance will be made forthwith.

Before resuming the description of the mill-movement, or flow-sheet, it is necessary to mention the automatic sampler, which is placed at the discharge of the conveyors feeding the bins. This sampler is based on the principle of taking part of the feed part of the time. A fraction of the flow, equivalent to 1%, is diverted every five minutes. After sampling, the ore is distributed by horizontal tripper-conveyors into the various pockets feeding the sections.

The following is a screen-analysis of the product as it leaves the crushing plant:

	Percentage weight material	Accum. percentage weight material
Opening 1.050 in.	1.17	1.17
" 0.742 in.	8.44	9.61
" 0.525 in.	22.27	31.88
" 0.371 in.	16.30	48.18
3-mesh	12.11	60.29
4 "	7.24	67.53
6 "	4.07	71.60
8 "	4.27	75.87
10 "	3.61	79.48
16 "	2.82	82.30
20 "	2.31	84.61
28 "	1.92	86.53
35 "	1.74	88.27
48 "	1.55	89.82
65 "	1.53	91.35
100 "	1.27	92.62
150 "	0.82	93.44
200 "	1.07	94.51
Pass 200 "	5.49	100.00

From the bins the ore is drawn by steel-apron feeders adjustable to three rates of speed by step-pulleys, to which is attached a mechanical counter, or tachometer, registering the number of revolutions of the head pulley of the feeder, so that it is easy to adjust the proportion of tonnage passing to the 13 sections into which the mill is divided.

We now confine our attention to one of these 13 sections.

CONCENTRATORS. From the two bin-feeders of the section the ore falls upon two Colorado Iron Works shaking-impact screens, 3 by 4 ft., set at an angle of 34°. The undersize, to which water is added, flows to 12 Garfield roughing-tables, these being modified Wilfleys with riffles extending the full length of the deck. The oversize from the impact-screens goes to two pairs of 15 by 37½-in. Garfield rolls of the movable pedestal type, the product from these passing to a bucket-elevator that lifts onto four impact-screens 3 by 4 ft. each, set at an angle of 34°. The undersize, to which water is added, from these screens joins the undersize from the previous screens, while the oversize is returned to the rolls, which puts the material in a closed circuit with the four impact-screens and the two pairs of rolls. The screen-mesh is varied between 6 and 10, depending upon the character of the ore and its moisture.

Various kinds of jigs were tried in the Copperton mill, including those of the Harz type, which was adopted, with trommels, when planning the original flow-sheet of the Magna mill. Later, the Garfield roughing-table was developed, and it proved to be more efficient than the jig, owing to the fineness of the mineral liberated by the crushing and the low ratio of concentration. At the time the Copperton mill was designed, the trommel-screen was in general use in the West and the impact-screen had not as yet been developed satisfactorily; when, at a later date, it was tried in the Magna mill, it proved to be more efficient and economical than the trommel. For these reasons the Garfield roughing-table and the impact-screen were substituted for the jig and

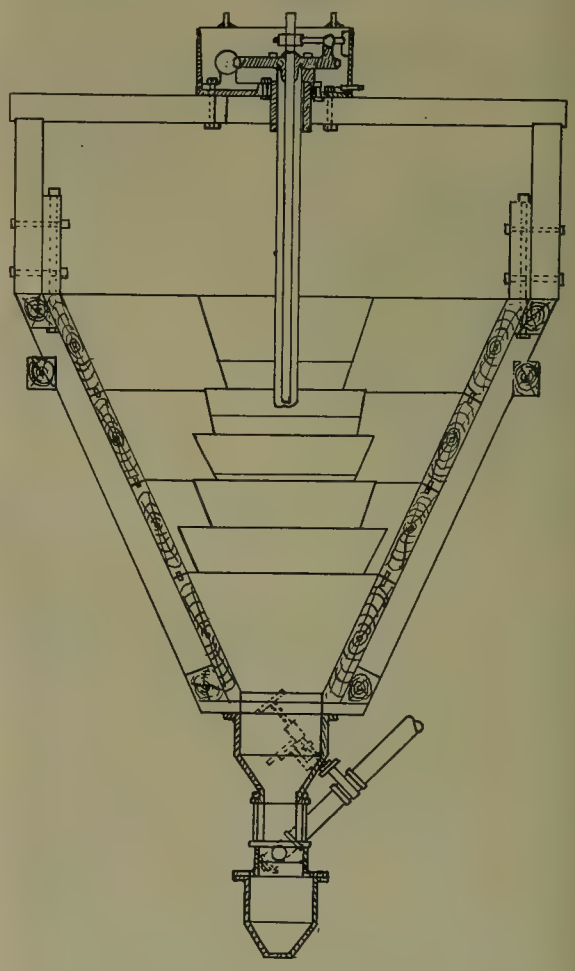


FIG. 3. THE RICHARDS-JANNEY CLASSIFIER

trommel as soon as the Copperton mill was overhauled and remodeled; but before these changes had been made in the Copperton plant the Magna mill had been equipped entirely with roughing-tables and impact-screens, and the same practice was adopted subsequently in the Arthur mill.

In one of the sections, I noted a Tyler vibrating screen. This screen is caused to vibrate by means of two hammers that strike pins in the centre of the screen. It is used as an experiment.

Now all the pulp is wet. Reverting to the roughing-tables, these produce a low-grade concentrate containing

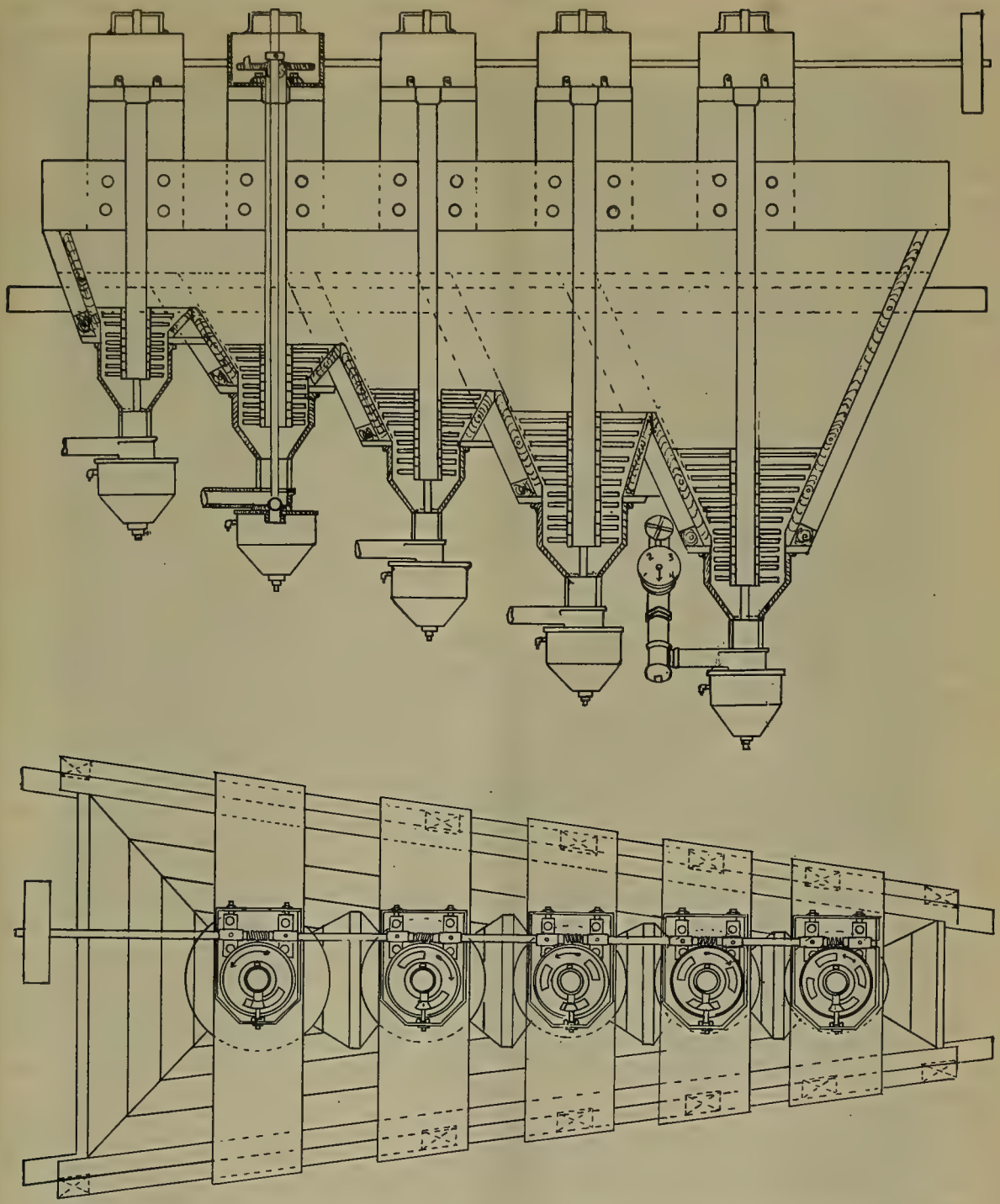


FIG. 4. PLAN AND SECTION OF THE RICHARDS-JANNEY CLASSIFIER AS USED IN THE ARTHUR MILL

all the coarse mineral as liberated by the precedent crushing. This concentrate is re-concentrated on four No. 5 Wilfley tables placed on the floor above the roughing-tables, the conveying being done by a bucket-elevator. The Wilfley tables yield three products: concentrate (the first finished product in the mill), middling, and tailing. The roughing-tables yield only middling and tailing. The middling from the Wilfley tables is returned to the elevator, which puts it in a closed circuit with the Wilfley tables.

Looking at the Wilfley tables, I noticed that the pyrite and chalcopyrite hide the finer chalcocite, so that the

heading is distinctly pyritic. It does not look like the product from a chalcocite ore. The coarse pyrite forms the top fringe, and includes large grains of chalcocite; then comes the chalcopyrite, with the finer iron pyrite and some of the fine chalcocite. On one table I noted a fringe of fine chalcocite behind the chalcopyrite. The inclination of all the tables, Garfield and Wilfley, is fixed.

The Wilfley concentrate (to which water is added) flows in a launder to the filter plant, while the tailing joins the roughing-tailing, so that united they flow to a 30-in. bucket-elevator discharging into four primary 4-compartment Richards-Janney classifiers. The first and second spigots of the classifiers feed the Chilean mills, the third feeds the tube-mills, the fourth feeds the secondary classifiers, while the overflow goes to the slime-flotation plant. The primary classifiers appear to play a highly important part, but F. G. Janney, Jr., the General Superintendent, informs me that it is intended to replace them with drag-classifiers, because close classification is not essential now that flotation supplements the water-concentrating method, for the reason that the making of slime is no longer a drawback to the successful recovery of the copper sulphide.

THE RICHARDS-JANNEY CLASSIFIER was designed by the late Frank G. Janney, Manager of Mills for the mining companies under Mr. Jackling's direction; it embodies the Richards hindered-settling principle with the practical features of intermittent discharge, retardation of flow, controlled settling, and hydraulic regulation. In classification two general principles are involved, namely, free settling and hindered settling, respectively, according to the action of the material in the settling-column. In free settling, the action takes place in a column so designed as to present a uniform cross-section and consequent constantly rising current of water, so that the particles of material are allowed to settle against the specific gravity of the water alone.

The hindered-settling action, on the other hand, is caused by constriction in the classifying column, causing a difference in the velocity of the water in this constricted cross-section; which results in the formation of a zone of material of increased density in that portion of the column where the water-velocity is lower. This zone consists of particles that settle against the slowly rising flow in the larger column, but will not descend against the rapid flow in the constricted section. This zone of material changes the general density of the settling-medium, and raises the sorting efficiency. Greater success has been attained by hindered settling than by free settling, because the former assists the concentrating machine by furnishing a feed properly sorted according to mass.

When the Magna mill was re-modeled, 76 of the Richards-Janney classifiers were installed as part of the regular equipment. The result was an immediate increase of mill-capacity, together with a decrease in the cost of milling, and an increased recovery. These machines are also a part of the equipment of the mills operated by the Ray Consolidated and Chino Copper companies, in which the use of them has proved similarly advantageous.

The points to be emphasized in the design of a hydraulic classifier are close hindered-settling classification, low water-consumption, flexibility in capacity, non-dilution of slime, low cost of maintenance, and adaptability to change of load. As will be seen from the following description, these objects have been attained in large measure in the Richards-Janney machine.

The classifier consists of a series of rectangular compartments increasing in size and stepping down from the free end, the lower part of each compartment constituting the settling-chamber. A cylindrical sorting-chamber and hydraulic chamber are attached to the bottom of each compartment, the hydraulic chamber being in the form of a tee of rectangular section. The hydraulic inlet is governed by a gate-valve, and the bottom of the hydraulic chamber has a flanged end tapped to receive the inner valve-seat bushing. Attached to this flanged end is the retarding-chamber, provided with an air-cock and tapped at the apex to receive the outer bushing. The feed-inlet and overflow-outlet are a few inches below the top of the sideboard, which extends along the top of the classifier for its full length. A cast-iron box with housing for the driving mechanism is supported above each compartment, the bearing for the spindle extending downward from the base of this box through the supporting frame. This spindle reaches downward into the centre of the sorting-chamber, and carries a series of sorting-blades driven through worm-wheels. Intermittent raising and lowering of the valve-rod are effected by means of cams attached to the worm-wheel. The valve-rod, which extends through the hollow spindle, is fitted at the lower end with a rubber valve, which sits on the inner bushing in the hydraulic chamber, as shown in Fig. 3 and 4. An arm fitted to the upper end of the valve-rod, and engaging with the cams on the worm-wheel, opens and closes the discharge-valve.

When in operation, the shaft revolves at about 80 to 90 r.p.m. Upon the feed entering the classifier the sorting-blades turn and loosen the pulp, without any raising or lowering action. The valve-rod is raised by the cam, opening the valve, which permits the material to pass through the inner bushing into the retarding-chamber. This chamber fills with sand and the valve-rod drops, closing the inner bushing. The material flows from the retarding-chamber through the outer bushing, and when the chamber is empty the classifier is ready for the next cycle.

Some of the main features of this classifier are close classification, economy of water, which ranges from 200 to 500 gal. per ton of ore, and large capacity. The standard 5-compartment classifier, from actual mill-tests, treats as much as 750 dry tons of ore per 24 hours, on material up to 7 mm. in size.

STAGE-GRINDING. Each section of the mill contains two Chilean mills, of 6-ft. diameter and of the Garfield type, the mullers making the circuit at the rate of 33½ per minute, and discharging through a No. 89 Tyler Ton-Cap screen having long narrow slots equivalent to 14 mesh. These grinding-machines are fed from equalizing-tanks, that is, storage-tanks intended to overcome the effects of

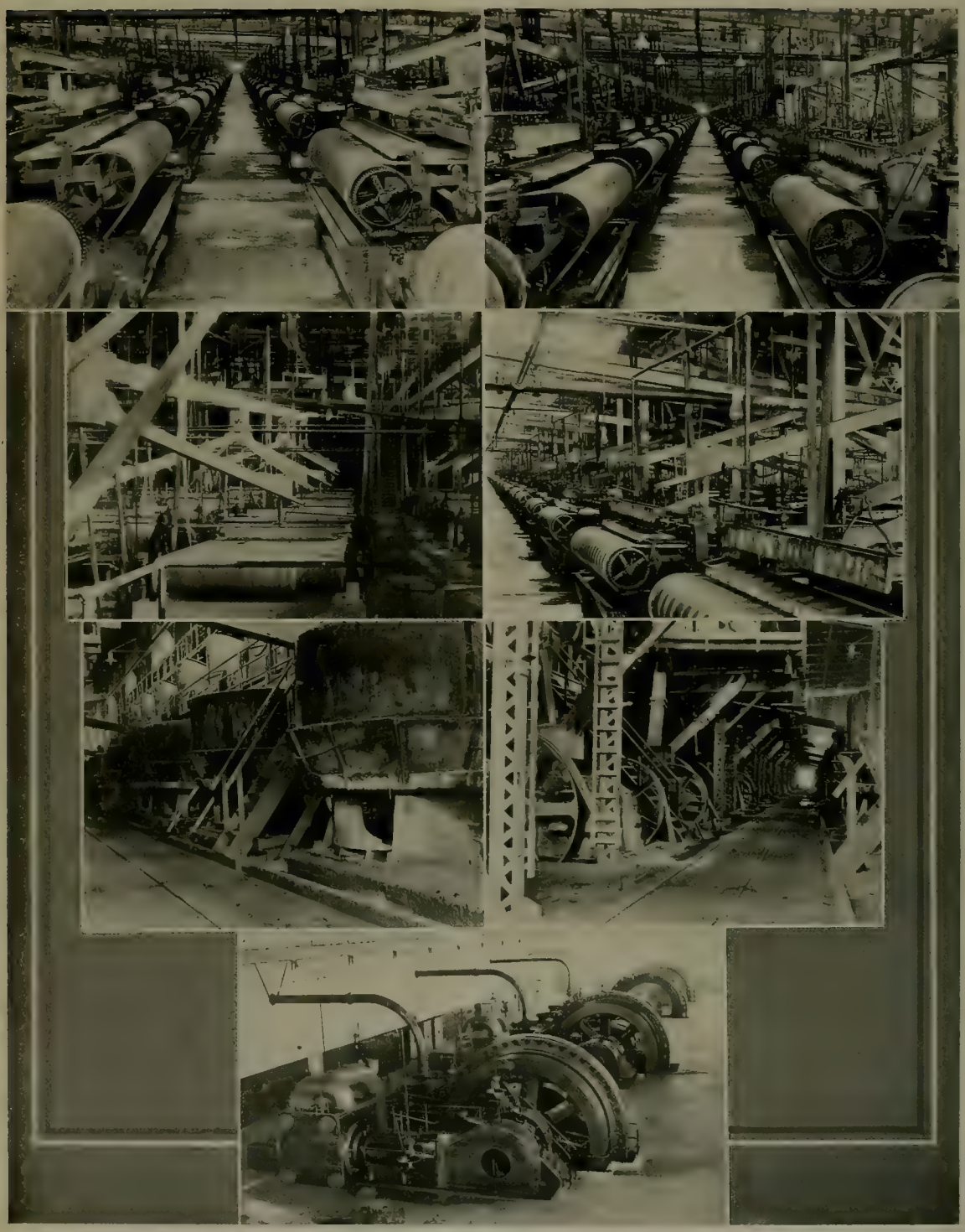
THE LATE FRANK G. JANNEY, MANAGER OF MILLS

MEMORIAL TO THE LATE FRANK G. JANNEY AT THE ARTHUR MILL

GRIZZLIES AND OVERSIZE HOPPERS

THE ARTHUR MILL, AT GARFIELD, LOOKING WESTWARD. RESIDENCES OF STAFF IN THE CENTRAL FOREGROUND

THE MAGNA MILL, AT GARFIELD, LOOKING TOWARD SALT LAKE. BINGHAM & GARFIELD RAILWAY ON THE RIGHT



VIEWS INSIDE THE MAGNA MILL

Second vanner-floor, looking west from Section No. 1.
Lower vanner-floor.
Chilean mills in fine-crushing department.
Second vanner-floor, looking west from Section No. 1.
First vanner-floor, looking toward classifiers.
15 fine-crushing rolls.

Power-plant, looking west. Two 1250-kva. Allis-Chalmers units and two of the three 200-kva. engines of the same make.

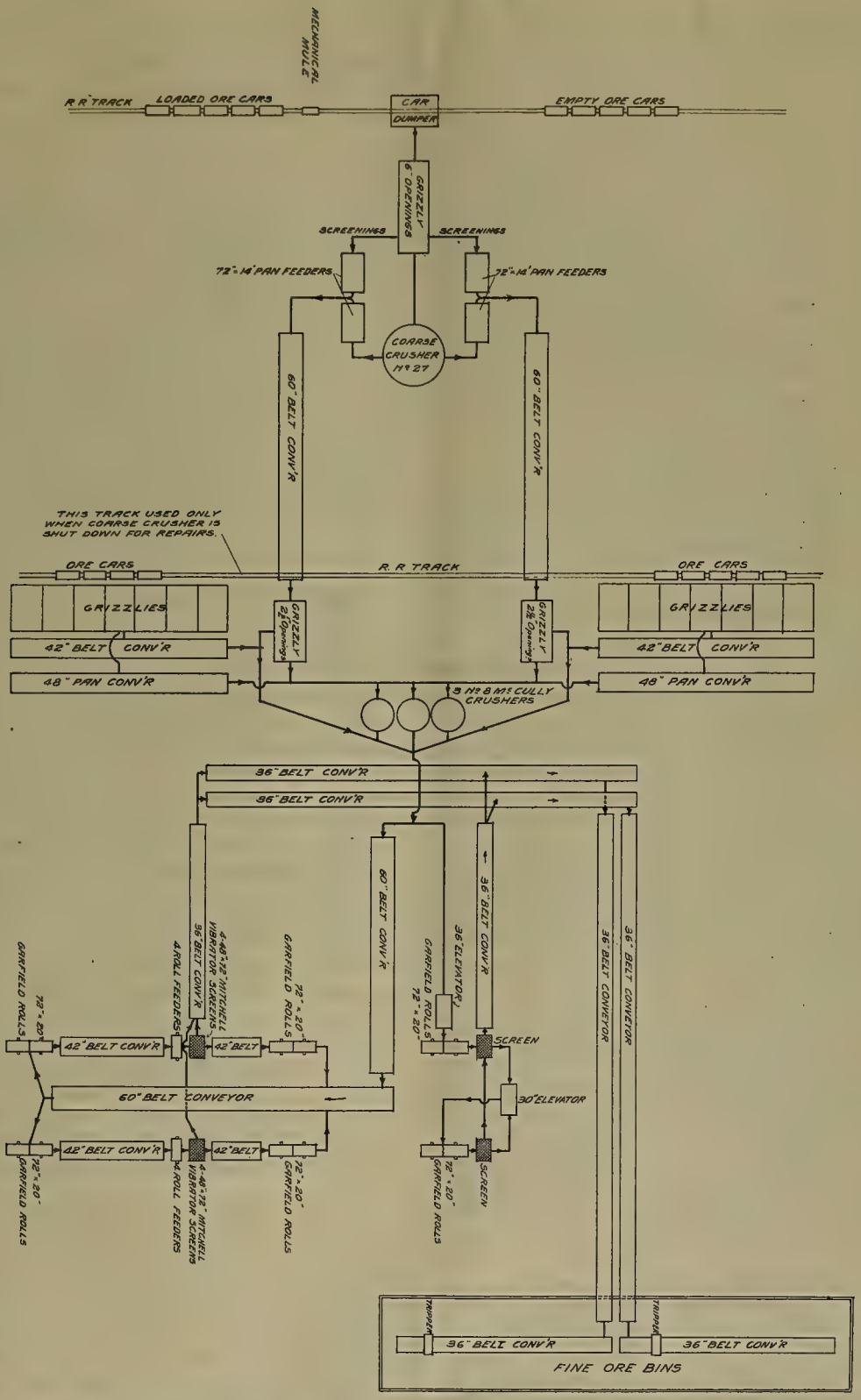


FIG. 5. FLOW-SHEET OF PRIMARY AND SECONDARY CRUSHING PLANTS IN THE ARTHUR MILL

a variable feed. The product from the Chilean mill joins the rolls-product and goes to the roughing-tables, forming a closed circuit with the primary Richards-Janney classifiers.

The two drag-classifiers, which are fed from the third spigot of the Richards-Janney classifiers, are of the Dorr, or interrupted eccentric, type. Each of them delivers to a tube-mill, 7 ft. diam. by 10 ft. long, also home-made, and differing from other types in being equipped with ring-liners that are self-locking, thereby obviating the use of bolts. The absence of bolts is noticed by the visitor, but the chief feature is a shell that does not leak. Not only is the nuisance of loose liners avoided, but, it is claimed, an increase of grinding efficiency is caused by the anvil action afforded by the solidity of the lining. Each tube grinds 350 tons in 24 hours, the reduction being such that the proportion of material larger than 48-mesh in the general mill-tailing has been lowered from 35 to 10%.

In some of the mills Californian beach-pebbles of No. 3 and No. 4 size are used as a grinding medium; in others, Adamant cubes; and in others, Manganoid steel balls. The average consumption of the Californian pebbles is 3.16, of the Adamant cubes 2.03, and of the Manganoid balls 1.23, pounds per ton of material passing through the mill. The horse-power is 61.3 for the mills using the Californian pebbles, 60.09 for those using Adamant cubes, and 142 for those using Manganoid steel balls.

The product from the tubes returns to the elevator that lifts the tailings from the roughing and Wilfley tables, and returns with them to the primary Richards-Janney classifiers, establishing a closed circuit. The overflow from the drag-classifiers feeding the tube-mills joins the overflows from the primary and secondary classifiers, going with them to the thickening-tanks that supply the slime-flotation plant.

VANNERS. The product from the fourth spigot of the primary classifiers passes to four secondary 5-spigot classifiers, also of the Richards-Janney type, where it is further classified by hindered settling so as to yield five products, each of which goes to a group of Isbell and Johnston vanners, thus:

First spigot to 8 Isbell vanners
Second spigot to 8 Isbell vanners
Third spigot to 8 Johnston vanners
Fourth spigot to 8 Johnston vanners
Fifth spigot to 8 Isbell vanners.

These vanners are provided with corrugated belts, 6 ft. wide and 10 ft. long; the Isbell is operated at a speed of 176 side-shakes of 1-in. amplitude per minute, and the Johnston at a speed of 132 side-shakes of 2-in. amplitude per minute. The slope of the vanner is 7° from horizontal.

The travel of the belt varies from 60 to 120 in. per minute. The belts seem to give remarkably good service; one that I noticed had been in use for over two years, and yet the corrugations were perfectly sharp. This belt was made by the Republic Rubber Co., I was informed.

The vanner-tailing goes to waste, this being the first waste-product to be recorded. The concentrate is collected in a box and flushed with fresh water at intervals so as to push it into an elevator that lifts it to two hydraulic classifiers, each of five spigots, the products of the first four spigots of each classifier going to two Wilfley tables, while the product from the fifth, with the overflow, goes to Dorr thickening-tanks and thence to the flotation re-treatment plant. This subsidiary table-concentration plant, therefore, consists of eight Wilfley tables, each of which has a corresponding vanner. Each of the Wilfley tables produces a finished concentrate, a middling, and a tailing; the middling is returned to the elevator, and is in a closed circuit with the classifiers and Wilfley tables, while the tailing is re-concentrated on its corresponding vanner, which in turn yields a middling that is returned to the elevator and is in a closed circuit, while the tailing goes to waste. The overflow from this last set of classifiers, with the product from their fifth spigot, goes to flotation, as I have stated, so that the water-concentrating operations end here.

On the first vanner-floor one detects the aromatic smell of flotation-oil; this becomes more intense as the flotation cells are approached, until in the midst of the flotation annex it has a lachrymose effect on the eyes. The spread of vanners on the lower floor is impressive owing to its extent, but I noticed that 20 out of 60 vanners in each section were idle, the slime that formerly went to them being now subjected to flotation, because as yet these vanners have not been equipped, as they will be, with the corrugated belts required to enable them to treat the sandy portion of the pulp. All the wooden vanner-floors have been propped, the ground underneath having been excavated previous to replacing it with concrete.

A laudable effort is being made at the two mills to erect attractive office-buildings and houses for members of the staff. The lawn and trees are pleasing to the eye, and must be much appreciated during the hot summer. A club-house and dormitory are to be erected at Magna, the dormitory to be open not only to the unmarried members of the staff but to any men of decent habits. In the centre of the group of buildings is a fountain erected as a memorial to Frank G. Janney. It reads:

In Memoriam

1866 F. G. JANNEY 1916

Manager of Mills

This memorial erected by the employees of the Magna Plant in recognition of his impartial leadership and as a token of their undying esteem.

To live in hearts we leave behind is not to die.

Dedicated May 12, 1917.

This is a thoroughly American tribute to a good worker and captain of workers. The man so memorialized has left not only an honorable memory, but two worthy sons, Frank G. Janney, Jr., and T. A. Janney, the elder being now general superintendent of both mills and the younger the superintendent of the Arthur plant.

(To be Continued)

The Decisive Battle of the War

By FRANK H. SIMONDS

[The following description of the Battle of the Hindenburg Line by Frank H. Simonds is one of the memorable writings of the War. Our readers will be glad to have it, even if they have read it before. By those to whom it comes fresh, it will be appreciated. We are enabled to print it by courtesy of Mr. Simonds himself and of the New York 'Tribune'. The map has been specially prepared for the purpose.—EDITOR.]

This battle, for which, perhaps, the name of the Hindenburg line, the geographical objective which was attained and passed, supplies the best title, extended over a front twice as extensive as that of the First Marne, hitherto the greatest in history; it was fought by not less than 4,000,000 men; it was immediately followed by the evacuation of more than 7000 square miles of French and Belgian territory, and a retreat as unmistakable and perhaps to prove as extended as that of Napoleon after Leipsic.

In this battle, in the larger sense, there was no geographical objective. The immediate obstacle before Foch was the Hindenburg line, which had to be broken, but the ultimate objective behind the line was the German army, which is not yet routed when these lines are written, but has been beaten unmistakably, and beaten in such fashion that the fact of Allied triumph is no longer denied in Berlin. Napoleon's problem after Leipsic is Germany's problem now, after the Battle of the Hindenburg Line; it is the problem of preventing the invasion of the home land and the overturn of the dynasty. Napoleon failed to solve his problem and was driven to abdication and exile; the task before William II is not lighter.

The Battle of the Hindenburg Line opened on September 26. On that date the Germans between the sea and the Meuse were substantially on the ground which they had occupied at the beginning of their offensive on March 21. Only west and north of Lille and south of Laon did they hold any valuable ground which had not been in their hands in the spring, while only east of Cambrai had they lost any important positions, likewise in their hands in March.

On all this front of nearly 200 miles the Germans stood behind a system of defence which had been elaborated over two and in some places over four years. They possessed all the points of vantage, and from Arras to Soissons they had before them that desert created by the famous Hindenburg retreat of 1917, which challenged the best efforts of Allied engineers to construct lines of communication for their advancing armies. Behind the Germans was an undevastated country with lines of communication developed during four years of occupation.

Between March 21 and September 26 the Germans had tried and failed to win the War by a colossal offensive. Their failure had cost them many prisoners and many guns, but they had not yet lost more prisoners or more guns than they had taken in the successful phase of their offensive. It may even be doubted if their total losses were much greater than those of their foe, although their practice of selecting the best elements in their armies and grouping them in storm units had exposed them to much heavier losses on their best material.

All things considered, the Germans stood in much the same position in which they had in previous years beaten off Allied offensive, notably at the Somme in 1916 and at the Aisne and in Flanders in 1917. Their problem was to make the Allied advance so slow and so costly that it would achieve no material results before bad weather ended the campaign and gave their diplomacy the opportunity, using the military deadlock as the basis for argument, to seek a negotiated peace based upon the idea that no military decision was possible. In this contest the Germans were outnumbered and outgunned, but not in any overwhelming degree. They had just as good a chance to win a defensive victory, so far as surface conditions were concerned, as they had in the three previous years.

The task of Foch was equally simple, but of unexampled magnitude. He had, in the few remaining weeks of the campaigning season, to break the German line, to force the German armies back over the whole front and to inflict upon them such a defeat as would abolish all question of the impossibility of a military decision and demonstrate that the War could be won by arms, and that therefore there was left to the Germans only the choice between immediate surrender and the persistence in a war which could have but one end, and would before that end came, bring the invasion of Germany itself.

Given the magnitude of the numbers involved and the extent of the front, there was small chance that Foch could achieve a Sedan, or even a Waterloo, unless there should be a sudden collapse of German morale, such as was not forecast by any recent event, and did not, as the event proved, occur during the course of the actual battle itself. What he had to do was to inflict a decisive defeat, which would once and for all put an end to the idea that a war of positions would have no other termination than a deadlock. He had to win such a victory as to prove that an old-fashioned decisive military triumph could occur even in contemporary warfare.

In sum, he had to do exactly what the allied commanders fighting Napoleon had to do—he had to defeat his antagonist in such fashion as to demonstrate that

ultimate and irrevocable defeat for the great foe was neither impossible nor improbable. He had to break the legend of the invincible German machine, now on the defensive, as the allies of 1813 had to break the Napoleonic legend. This, all of it, he did accomplish between September 26 and October 15. In that time the whole opinion of the civilized world, Teutonic and non-Teutonic, was brought to the common point of recognition that Germany had lost the War irrevocably, and all that could occur in the future would be the victorious exploitation of the Battle of the Hindenburg Line.

In solving his grandiose tactical problem, Foch opened his battle on the flanks, reserving his main thrust for the centre and for the appropriate moment. Thus, on September 26, it was Liggett's First American Army, in conjunction with Gouraud's Fourth French Army, which delivered the blow on the German left, while King Albert's Belgian Army and Plumer's Second British Army delivered the blow on the German right.

The Franco-American blow resulted in a swift advance by the Americans north of Verdun, the capture of Montfaucon and a dozen other towns and villages on the west bank of the Meuse and between the Meuse and the Argonne villages famous in the campaign for Verdun of 1916. The immediate effect of this advance was to break the German domination of the Paris-Chalons-Verdun railway, which had been cut by indirect fire for more than four years. Gouraud, on his side of the Argonne, pushed north and took all the ground famous in the Battle of Champagne of September, 1915, which had begun one day earlier.

This advance was then halted, as was inevitable, because it was an immediate threat to all the German lines of communication between Alsace-Lorraine and the Rheims-Laon front and particularly to the Metz-Mezieres-Valenciennes railroad. Ludendorff had to send reserves to the endangered front at once, and these reserves, on their arrival, succeeded not in stopping either the French or the Americans, but in slowing down their advance. The purpose of the operation had, however, been already achieved by the strain made upon German reserves.

Meantime the Belgians and British had been even more successful. Emerging form Ypres and the old Yser front they had taken Dixmude, the Forest of Houlhoust, and all the ground won in the offensive last year and lost this spring. They had crossed the Passchendaele ridge and broken out upon the Flanders plain, swiftly advancing toward Roulers on the north and toward Menin on the south-east. A wedge was thus driven between the German armies on the coast and about Lille. Lille itself was threatened with envelopment and, as the event proved, the German hold upon the Belgian coast was broken.

Once more a new strain was put upon German manpower. Although he must have recognized that he could not permanently hold the Belgian districts between the Scheldt and the sea, Ludendorff was obliged to gain time in which to remove the enormous accumulation of supplies and guns in the doomed region. Accordingly he sent more reserve divisions to Flanders and for the moment the Anglo-French drive slowed down. It did not stop, neither here nor between the Meuse and the Argonne was pressure relaxed, but for the moment Allied purpose was achieved and no useless sacrifice of men was made in too eager exploitation of undeniable success.

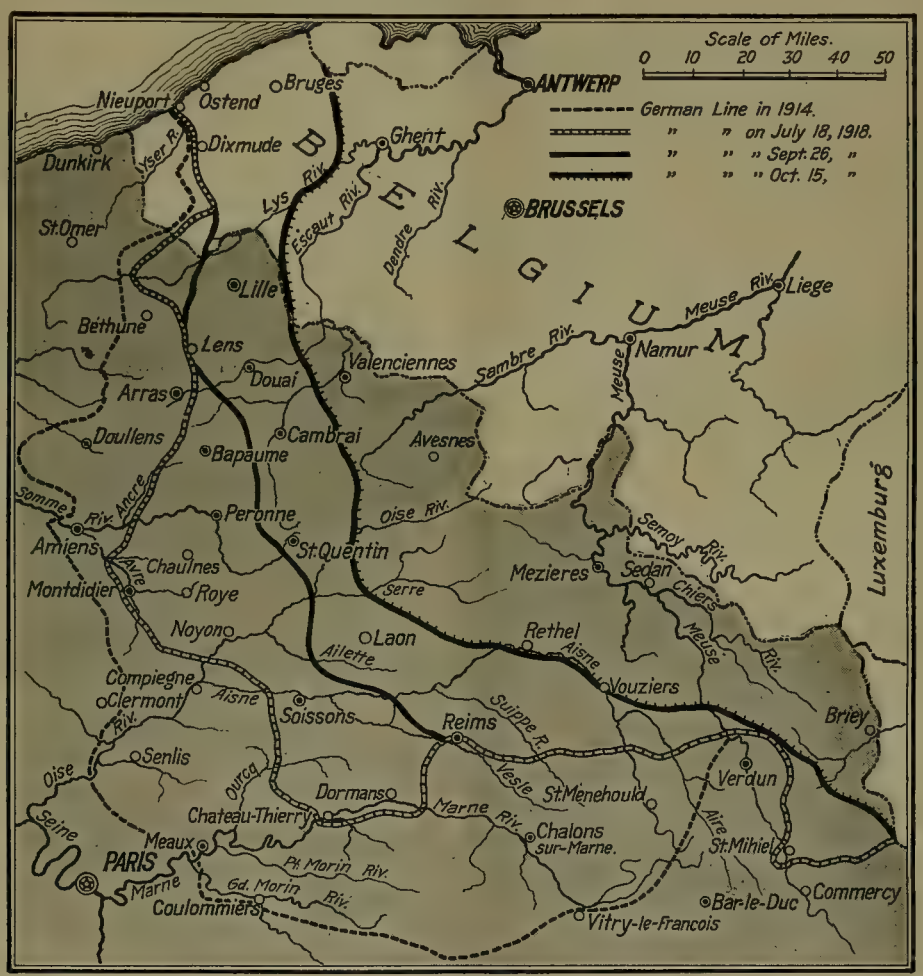
Having made Ludendorff anxious for both his flanks, Foch was now ready for his master-stroke. Already the British between the Scarpe and the Somme, between Douai and St. Quentin, had been active, had pushed forward and taken many valuable 'jumping-off' places. But on October 8, on the front between Cambrai and St. Quentin, aided by Debeney's French army between St. Quentin and the Oise, three British armies, those of Horne, Byng, and Rawlinson, struck. What happened was the greatest British achievement in all the centuries of British warfare on the continent. All the past disappointments were banished, all the old defeats were avenged; in three days the British drove straight through the 12 miles of the Hindenburg line, on the front where it was strongest, and pushed out into the open country beyond. By October 12 they were in Le Cateau. St. Quentin had fallen, the fall of Cambrai was assured, the old battlefield of First Cambrai, where Smith-Dorren's half of Sir John French's expeditionary army was almost destroyed, had been crossed by the victorious British. The Hindenburg line was a memory. This fact, too, should be emphasized, the British thrust was the final thrust of the whole battle. In the decisive battle of the World War Foch had called upon Haig's armies, as Napoleon was accustomed to call upon his Old Guard, and the British had made the response of the Old Guard. For the British this battle was the Third Battle of Cambrai, a detail in the vast battle of Foch, but it was, for the world, the decisive stroke in the winning of the War.

The consequences of the British success were immediately enormous. Their own advance was checked a few miles south of Valenciennes on the line of the Selle river, just north of Le Cateau, but their halt was exactly like that of the operative forces on the flanks. They had accomplished their purpose, they had broken the Hindenburg line, they had driven a wedge deeply into the German front and the Germans both in Lille and in all the new salient to the south between the Oise and the Aisne, including Laon and the St. Gobain forest and facing Rheims, were in a dangerous posture. The centre had performed its mission, it was time for the flanks to come to life again.

Once more the Americans and Gouraud, aided by Berthelot's army facing Rheims, struck northward. What followed was a swift German retirement between the Argonne and Rheims, the surrender of all the positions held since the retreat from the First Marne in September 1914, including the old forts above Rheims, from which the cathedral had been ruined and the city destroyed. Less precipitately, but no less inevitably, the Germans began a retirement between the Oise and the Aisne which cleared Laon and the St. Gobain forest

and surrendered that great central stronghold on which all their line in Northern France had been based. Meantime the Americans, far out beyond the Argonne, were slowly blasting their way forward and had reached Grandpre Gap, having cleared the Argonne. Thus the pressure upon the flank, instead of diminishing, grew and the Second American Army arrived in the battle line to add to the pressure.

But Foch was now done for the moment both with the German centre and left. Turning to the right, about Lille, to which front he had hurried Degoutte's French



MAP OF NORTHERN FRANCE AND BELGIUM

army, last heard of south of the Marne in July, he again pushed his wing forward, broke through all the German lines of defence and swept onward to the Lys in the south-east, to Roulers and Thiel in the north, and to Bruges and Ostend in the north-west. A swift collapse of German resistance followed. By October 16 the Germans were gone from the coast, Lille, Roubaix, and Tourcoing were evacuated, the Germans were stirring behind the Scheldt from Ghent southward. On the other side of the Lille salient, Douai had fallen and by the end of the week Horne's troops were approaching Valenciennes from north of the Sensee canal, while Byng's army was thrusting toward it from the south.

Thus, in three weeks Foch had upset the equilibrium of the whole German front from the sea to the Meuse. He had compelled the retreat from the Hindenburg line, with all its various annexes, he had ensured a retirement out of all French territory west of the Meuse, he had liberated Belgium west of the Scheldt, he had defeated the German army in a battle which they had accepted, on their own ground, prepared by them over four years. The ultimate consequences of his success were still problematical, no man could say exactly at what point the Germans would undertake to make a stand, but it was already certain that they would be unable to stand within French territory, the liberation of France had been accomplished, the advancing Allied armies were welcomed by thousands of French men and women, who had endured four years of slavery; for them the long night was over.

Such in its roughest form was Foch's supreme victory. It was not won over a demoralized enemy. On the contrary, the Germans fought with great persistence and

bravery. It was not the consequence of a collapse of their high command, for even after the defeat was assured the German armies were drawn back with great skill and unmistakable military efficiency. It was not in the first three weeks a rout, as Leipsic had not been a rout, but it was one of the most clearly cut victories in all military history, and for the Germans it was a defeat which terminated all hope, not merely of winning the War, but of imposing a deadlock. After the battle of the Hindenburg Line the certainty of a military decision was unmistakable.

If one wanted a parallel for Foch's tactics, one might perhaps cite the method of Lee at Gettysburg. In this battle the great Southern General attacked first by the left flank, then by the right, and finally threw Pickett upon the Union centre. Both of his flank operations were measurably successful, although neither led to any decisive advantage, but in the case of the centre Pickett was utterly unsuccessful and suffered a bloody repulse which left Lee's army incapable of renewing the offensive. Foch, on the contrary, was able to co-ordinate his three strokes in such fashion that when he struck the centre, the blows already delivered on the flanks had made a heavy draft upon Ludendorff's reserves, and not impossibly led to a weakening on the decisive front.

But, of course, all parallels are deceptive, and we are now dealing with a struggle on 200 miles of front, where Gettysburg covered less than ten.

The merit of Foch's strategy has lain in his ability to expand the pressure over a very wide front and multiply his partial thrusts so that the enemy was never able to get his breath and never able to anticipate in which direction the next blow was to fall. In a word, you have the difference between a brute and a man trained in self-defence. The brute undertook to destroy his antagonist by a few terrible blows. Foch parried or dodged these, and then began to play his antagonist, putting him on the defensive at the Second Marne, worrying him at the Third Somme, and making his ultimate defeat beyond question at the battle of the Hindenburg Line. Never was the superiority of French to German military science more perfectly revealed. French, like German, strategy is based upon Napoleonic principles, but while the German only imitated Napoleon, the Allied commander-in-chief interpreted him.

In a sense, all that is to come hereafter must be an anti-climax. The battle which we have witnessed at the Hindenburg Line is unquestionably the greatest battle of the present war as it is the most tremendous conflict of all human history. And in it has been revealed one of the supreme soldiers of all time. Henceforth and because of the achievement which has just unrolled before our own eyes, Foch will be recognized as one of the half-dozen great commanders of armies, the master of the present armies in human history, and the successful wielder of the most intricate and colossal military machine of which we have any knowledge. His three months from the Marne to the Scheldt, his campaign in Northern France in July, August, September, and October of the current year, with his three great successes, Second Marne, Third Somme, and the Battle of the Hindenburg Line, must be memorable for all later generations of soldiers who study the methods of war.

Such, then, was the Battle of the Hindenburg Line, as I see it, the Leipsic of the German imitators of Napoleonic ambitions as well as of Napoleonic strategy. But even this grandiose campaign was but one phase of the Foch strategy. He set out to drive the Germans out of France, to rout them if he could, to win the decisive battle in any event, and to this extent he held to the familiar theory of the 'Westerners', that only in the West could the War be won or lost. But in doing this he did not forget the East.

In this respect his calculations were clear. German victory in the War depended upon two things, the defeat of the enemy in the west and the preservation of that empire in the east, which was known to all the world as Mitteleuropa. If the eastern empire collapsed, then only a decisive victory, a new western Sedan of the enemy, would bring victory to Germany. But if the east were held, Germany could put up with nothing better than a deadlock in the west, a long drawn out and much magnified repetition of the Somme of 1916. She could calculate that unless the Allies could win a decisive victory in the west they would bargain with her for peace in the coming winter, and in that bargaining she could trade western holdings for eastern conquests.

Accordingly, before he launched his great western battle, Foch threw Allenby against Turkey in Palestine and D'Esperey against Bulgaria in Macedonia. The result of these two thrusts were immediate and final.

But the victory over the Bulgarians was even more costly to the German. Even before the battle of the Hindenburg line has reached its decisive phase, Berlin knew, not merely that Turkey had been crushed, but also that the Bulgarian army had been routed and that Bulgaria had surrendered unconditionally.

The Foch strategy has to be seen whole to be appreciated in its full splendor. He co-ordinated the operations in Palestine and Macedonia with those in Flanders and Champagne, the result being the most wonderful climax of any military campaign. Damascus, Beirut, Uskub, Nish, Lille, Douai, Cambrai, and St. Quentin fell, if not at the same moment, at least in rapid succession; the world, German as well as Allied or neutral, had the sudden impression of the visible collapse, the simultaneous collapse of all the various elements in the German world empire. In the second week of September that empire reached the Jordan and the Euphrates on the south and touched the North Sea on the Belgian coast. By the end of the second week in October it stopped at the Danube and was rapidly receding from the Belgian coast. Its Austrian faction was crumbling into ruins and its Bulgarian and Turkish departments were in dust and ashes. Belgium and Serbia were emerging from the German waves. France was rapidly clearing of German occupation—for the German the whole world had suddenly turned upside down—for the rest of us it was assuming its normal position.

The battle of the Hindenburg line won the War.

A Rapid Method for Determining Titanium and Chromium in Beach-Sand

By E. P. BARRETT

*Tests have been made at the Pacific Northwest Experiment Station of the U. S. Bureau of Mines, at Seattle, on the magnetic concentration of various beach-sands carrying chromite and magnetite, with titanium. Different methods of analysis were tried with varying degrees of success. This work resulted in adopting a method that depends upon the fact that a fusion of the sand with sodium peroxide leaves the iron as insoluble ferric hydroxide, and the titanium as sodium titanate insoluble in an excess of sodium hydroxide, while the chromium is in the form of sodium chromate, which is readily soluble in the excess of sodium hydroxide. A perfect fusion is assured in all cases, and rarely requires heating for more than five minutes over a Meeker burner. The details of the method are given herewith.

Five-tenths to one gramme of the ore, through 150-mesh, is weighed into a porcelain crucible containing about 6 or 8 gm. sodium peroxide. The ore is mixed with the peroxide and fused over a Meeker burner. Hold the crucible in tongs, so as to rotate the contents after fusion begins. Heat slowly at first. In case a perfect fusion is not obtained by the end of five minutes, cool, add a little more peroxide, and heat again.

Insert the crucible in a 600-cc. beaker about two-thirds full of water, place on a hot plate and boil for at least 15 minutes. Cool in a tray of running water (10 minutes will suffice). Filter and wash with dilute sodium hydroxide. All the iron and titanium is in the residue and the chromium is in the filtrate. Save this for the chromium determination.

Wash the residue through the filter with hot 10% sulphuric acid. Wash well with hot water, and add 10 cc. hydrochloric acid. The filtrate should now be about 100 cc. Proceed now in accordance with the following method, which is essentially that described by P. W. and E. B. Shimer, Proceedings of Eighth International Congress of Applied Chemistry, but modified somewhat by Scott†, differing principally in the form of reductor and also in a few details of operation from the Shimer method.

Dissolve about 30 gm. of ferric ammonium sulphate in 300 cc. water, acidified with 10 cc. sulphuric acid; add potassium permanganate drop by drop as long as the pink color disappears, to oxidize any ferrous to ferric iron, and dilute to one litre. Standardize this solution in terms of iron. The iron value times 1.4329 gives the value per cubic centimetre in terms of TiO_2, and the iron value times 0.86046 gives the value per cubic centimetre in terms of metallic titanium. Use a saturated solution of potassium thiocyanate as the indicator.

As a reductor a 500-cc. dispensing burette is used. The internal dimensions of the burette are about 1⅝ by 22 inches. The reductor is charged with 1200 gm. of 20-mesh amalgamated zinc, making a column about 12 in. high and having an interstitial volume of 135 cc. This form of reductor is convenient, and when used as hereafter described is adapted to maintaining hot solutions, essential for complete reduction of the titanium. The reductor is connected to a litre-flask for receiving the reduced titanium solution through a three-hole rubber stopper, which carries also an inlet-tube for carbon-dioxide supply, and an outlet tube for connecting with the suction-pump.

The reductor is prepared for use by first passing through it a little hot dilute sulphuric acid followed by hot water, finally leaving sufficient hot water in the reductor to fill to the upper level of the zinc.

The hot titanic solution, prepared as described above, is now introduced, about 100 cc. of the water being drawn from the reductor into the original beaker to bring the solution to about the upper level of the zinc. The water thus removed will not contain any titanium if the operation has been conducted as described, but it serves as a safeguard and is also convenient to acidify this water with 10 cc. sulphuric acid and reserve on the hot plate to be used as an acid wash after the reduction of the sample solution.

The titanium solution is allowed to remain in the reductor for 10 minutes. While the solution is being reduced, the receiving-flask is connected with the suction-pump, the air in the receiving-flask is displaced by carbon dioxide, and, while continuing the flow of carbon dioxide, the reduced solution is drawn out, followed by the reserved acid wash and then three or four 100-cc. washes of hot water. The displacement of the sample solution and the washing of the zinc is so regulated by means of the stopcock that the reductor is always filled with solution or water to the upper level of the zinc. When the washing is complete, release the suction gradually to prevent air being drawn into the receiving-flask.

Disconnect the flask, add 5 cc. indicator, and titrate immediately with ferric ammonium-sulphate solution

*By courtesy of the Director of the U. S. Bureau of Mines. The author is assistant-chemist to the Bureau.

†Scott, Wilfred W., 'Standard Methods of Chemical Analysis'.

until a brown color is produced, which will remain for at least one minute.

The filtrate containing the chromium is acidified with about 20 to 30 cc. sulphuric acid. Pour the solution into a 1½-litre beaker containing about 600 cc. water. Run in excess ferrous ammonium-sulphate solution, about 90 gm. per litre, using potassium ferri-cyanide as an indicator. At once titrate excess ferrous ammonium sulphate with potassium permanganate to a faint pink and point.

To standardize the ferrous ammonium-sulphate solution, weigh out portions of pure potassium dichromate of about 0.25 gm. This weight times 0.518 gives the value in Cr_2O_3. Dissolve in water. Dilute to about 1200 cc., add 20 cc. sulphuric acid, and run in excess ferrous ammonium sulphate, titrating excess with permanganate. Determine the value of 1 cc. permanganate solution in terms of ferrous ammonium-sulphate solution so as to be able to calculate the number of cubic centimetres of ferrous ammonium sulphate actually required to titrate the Cr_2O_3. Run 15 or 20 cc. ferrous ammonium-sulphate solution into about 1200 cc. water containing about 20 cc. sulphuric acid and titrate to a faint pink with permanganate. The permanganate solution used for iron determinations is employed in this method; it need not be standardized. It is advisable to standardize the ferrous ammonium sulphate every time it is used.

This method is also used to make assays for Cr_2O_3 in chromite. An assay can be made in about one hour. When assaying for Cr_2O_3 only, it is advisable to use an iron crucible for the fusion.

Colloids and Flotation

The U. S. Bureau of Mines has issued a technical paper, No. 200, to show the application of certain facts of colloidal chemistry and physics to flotation practice. Some of the unexplainable troubles in the flotation plant can probably be explained by the study of colloids. It draws attention to the fact that at times some sulphides are not wetted by water and under other conditions are wetted. The last case is, of course, an abnormal one and when this condition obtains flotation is impossible. It can probably be explained by adsorption.

The adsorption phenomena are an effect due to surface-energy. Surface-energy is a product of surface-tension multiplied by area. Therefore, the adsorption phenomena are affected by any factor that tends to increase or reduce surface-tension. The surface-energy and adsorption effects for solids can only be proved by analogy of the action of liquids and gases.

Willard Gibbs developed a thermo-dynamic formula to show that adsorption is due to a concentration of molecules in the surface of solids or liquids and that it can be either positive or negative; therefore, any material that will give negative adsorption for water would, of course, probably give positive adsorption for gases. Impurities in solution tend to upset surface-energy conditions and would cause positive adsorption for gases to be changed to negative adsorption for them. As adsorption is manifest by wetting or non-wetting in our case, it is seen that under certain conditions some sulphides can be wetted by water while others cannot.

In dealing with a solid, water, and oil phase the action of adsorption toward the solid will be the algebraic sum of the surface-energies of all the material entering into the sphere of action. Hence any substance that tends to upset the surface-tension or energy of any one of the three or four phases involved would tend to change the resultant surface-energies of all of them and hence upset the conditions that have been established for adsorption of either the water or the gases involved. It follows that any impurities in solution in the water would tend to affect this algebraic sum and hence upset the equilibrium necessary to float the sulphides from the pulp; also, as the surface-energy is the product of the surface-energy multiplied by the area, the presence of any material having largely developed surfaces, principally colloids, would tend to upset the equilibrium and the flotation.

As size is such an important factor it is plain that the oil can be too much emulsified. In fact, when the oil is in an extremely colloidal condition it is impossible to get good flotation results. The fact that the materials which tend to throw the oils out of emulsion are substances that benefit flotation is a proof of this statement.

A practical illustration of some of these deductions is obtained in the Inspiration mill, where it was found to be impossible to float the copper sulphide from the gangue containing large amounts of decomposed material, such as koalin, which is a colloid. No trouble was encountered in floating the hard undecomposed ore.

There are several different types of colloids, but the most important are the so-called irreversible and reversible colloids. The irreversible colloids are those most liable to be present in ore-pulps, being iron, aluminum hydroxide, etc. They are called 'irreversible' because it is impossible to put them back in colloidal condition after having once flocculated them by means of an electrolyte. The 'reversible' colloids are those that can be put back into colloidal condition by simply shaking after flocculation. They are inactive toward electrolytes. Among such colloids might be mentioned aqueous solutions of gellatine, glue, gum, tungstic acid, and molybdic acid. These cause great trouble in flotation and are difficult to remove.

Protective colloids should also be mentioned. They are simply colloids that prevent the precipitation of the irreversible colloids, making impossible their removal by means of electrolytes. Common ones are soapine, tannine, glue, and humic acid. It is recognized as impossible to float in the presence of this type of material.

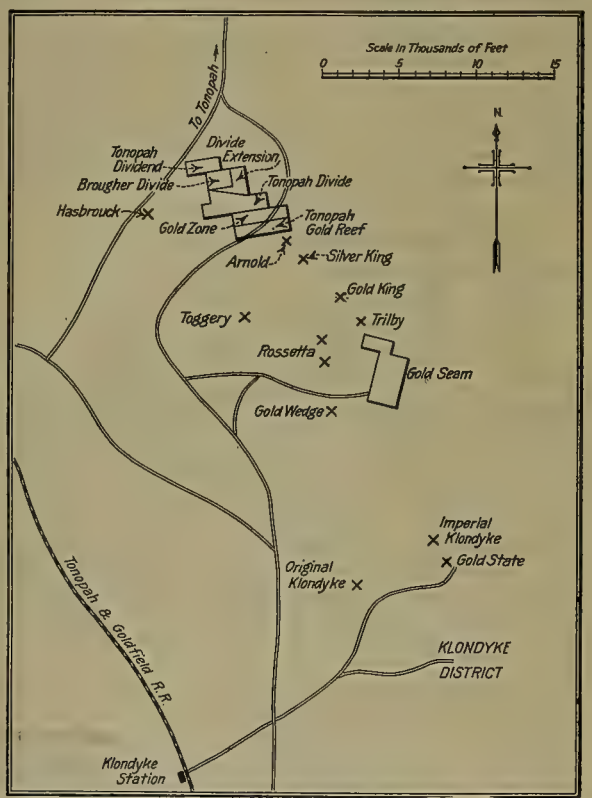
From the above short discussion several conclusions may be drawn. Evidently colloids interfere greatly with flotation and in order to overcome the difficulty they must be removed. There are several ways of doing this, among them being preliminary heating of the ore, washing the ore, or flocculation by means of electrolytes. These are the means of removing irreversible colloids. So far as is known, there is no way at present of overcoming the difficulty due to productive or reversible colloids.

TONOPAH, NEVADA

The Divide District, Particularly the Tonopah Divide Mine.

On the 260-ft. level of the Tonopah Divide mine, in the Divide district, six miles south of Tonopah, a cross-cut to the south has penetrated the 'gold vein' that outcrops near the summit of the divide and has a strike parallel to that of the main ore-channel. The cross-cut has exposed seams of ore assaying $75 per ton. This vein yielded high-grade gold ore from shallow workings, and it was for the purpose of prospecting this vein at depth that the main shaft was sunk. A cross-cut south on the 160-ft. level exposed the big vein that has now been thoroughly developed on the 160, 265, and 370-ft. levels. The orebody has been opened for 300 ft., showing an average width on all levels of over 25 ft. Engineers have estimated the ore blocked out at over $3,000,000. The gold vein has been cut at a distance of 570 ft. from the shaft and over 400 ft. below its apex, which is high above the collar of the main shaft. George Wingfield, one of the principal owners of the mine, says that the cross-cut will be continued to cut another vein to the south, and drifts will be started at once both ways on the gold vein. An auxiliary hoist has been put in at the station on the 370-ft. level of the main shaft for the purpose of sinking to water-level, estimated to be not less than 700 ft. Drifts are being advanced in the vein on the three main levels, and on the two lower levels raises and cross-cuts are being driven at 50-ft. intervals to block out the ore. All working faces are said to be in good ore. Cross-cuts from the shaft entered the vein near a vertical fault. North-west of the fault the ore is of better grade than south-east; the hanging-wall drift on the 370-ft. level to the north-east broke ore for a distance of 120 ft., averaging above $50; while the average of 26 ft. across the vein in the north-east cross-cut was $62 per ton. South-east of the fault the ore, of equal width, varied from $15 to $30 per ton. Molybdenite appeared in considerable quantity on the 160-ft. level, but at 265 ft. it has been found only in a few small seams; it is rarely found on the 370-ft. level. The ore-dump near the shaft contains over 6000 tons that is reported to assay nearly $30 per ton in silver and gold, all extracted during development. This ore is being shipped at the rate of 220 tons weekly to the Goldfield Consolidated mill, where it is treated by cyanidation. The ore is hauled seven miles to Klondyke station on the Tonopah & Goldfield railroad, where it is loaded in ore-bins from a platform, thence 15 miles to the mill. Flotation tests on this ore indicated a satisfactory extraction, but cyanidation was adopted because of existing obstacles to the marketing of flotation concentrate. The mine has been equipped with an excellent surface plant, driven by electric power and with capacity for a large amount of development. Production will not be increased much for the present, as it is designed, in view of the labor shortage and high cost of mine supplies, merely to meet operating costs and provide a surplus that in another year will afford means for mill or railroad construction, as the need shall then be determined.

Several other properties in the district are being developed, notably the Brougher Divide, Gold Zone, East Divide, and Hasbrouck. Others, including the Divide Extension, Tonopah Dividend, Gold Reef, and Sutherland Divide, are to be worked as soon as funds are available. The East Divide is sinking near the hanging wall of what is believed to be the Divide vein, at a point where the quartz outcrop assayed $5 per ton in gold. Nearly all of these properties have been equipped with good electrically-driven surface plants. Locations have been filed covering a large area



PROPERTY MAP OF DIVIDE DISTRICT, NEVADA

surrounding the Divide mine, and some good ore has been found in surface work at a half dozen points a mile or more from the central properties.

Shortage of labor at Tonopah has been less pronounced than in some other Nevada districts, on account of the large number of foreign-born men who have been placed in deferred classifications in the draft, or who have been granted exemption as enemy aliens. Many of the miners are Austrians or Slavs of Austrian nationality.

LEAD, SOUTH DAKOTA

General Notes From the Black Hills.

Lead.—Owing to shortage of labor the Mineral Point mill of the Homestake company has been stopped. This will decrease the daily output by 500 tons. The total number of stamps dropping heretofore was 1020, but with this plant out of commission leaves 920.

One car of tungsten ore has been shipped from the Bismarck and Wasp mines to Colorado. The cyanide plant that has been treating ore from the Bismarck has been closed after being in commission for the greater part of the year.

Deadwood.—Good progress is being made in the driving of the tunnel at the Titanic property in the Carbonate district. The compressor at the Iron Hill mine is at work. The air is piped a distance of 1500 ft. to the portal of the tunnel, where it will be used by machine-drills. Driving of the tunnel has been let on contract, and will prospect considerable virgin ground in a once famous silver district.

Custer.—The Rare Minerals Co. is a new corporation that has been formed by local people to mine and treat minerals in the Custer district. A small concentrator is under construction and will be used for dressing tin, tungsten, and rare minerals. The plant should be in commission before the first of the new year.

Roubaix.—The Custer Peak company has erected a steam hoist and compressor at the Jungle mine, which was recently purchased, and sinking of the shaft has been commenced. At present the shaft has a depth of 125 ft., and this will be continued to 400 ft. The 'ore vertical' has a width of 10 ft., and gives returns of 8% copper. A small concentrator has been erected, and will be operated along with the sinking of the shaft.

VICTORIA, BRITISH COLUMBIA

Chrome Deposits.—Gold in Cariboo District.—Roads in Mining Districts.—Skeena Copper Deposits.—Manganese on Vancouver Island.—Gold from America.

Under the terms of a recent Order-in-Council, the Canadian War Trade Board is authorized to take possession and to operate for a period of five years if necessary any mines or properties in Canada that are producing chrome ore or which have produced it in the past. War conditions have led to the taking of this step, it being explained that lack of shipping has created a serious shortage of chrome in America and for other Allied nations. It is known that undeveloped chrome exists in different parts of the Dominion, some in British Columbia. In the event of the War Trade Board and the owners of such mining properties being unable to come to terms as to the amount of compensation to be paid, provision is made for reference of the question to the Exchequer Court for adjustment.

Gold-producing possibilities of the Cariboo district, which has an output aggregating $65,000,000, is the subject of an interesting report by B. B. McKay, of the Provincial Branch of the Dominion Geological Survey. He spent a good part of the summer in that district. Notwithstanding the heavy increase in the cost of mining operations, production is going on steadily. He predicts that in many parts of the country there will be much gold recovered, but does not look for this development until after the War, when labor becomes more available. The use of hydraulicking, dredging, drag-line scraping, etc., will make conditions better. Lack of transportation facilities is holding back development, there being areas in the vicinity of Keithley and Harvey creeks that want even the roughest of wagon-roads.

One of the most important public works undertaken by the Mines Department of British Columbia, with a view to opening a promising mineral district, is the construction of what is known locally as the Big Bend road, which runs from the Revelstoke north along the Columbia river. The country is rough and mountainous and the work is expensive. The road now is open to La Forme creek, where are situated a number of promising mining prospects.

Erection of the new plant in preparation for winter operations is occupying the attention of the Delta Copper Co. This property is situated on Rocher de Boule mountain, Skeena district. Latest reports are to the effect that on the east end of the claims, at an elevation of 6250 ft., an orebody is blocked out on the upper vein. On the west there is 6 ft. of ore, and lying between these workings is 22 in. of chalcopyrite that assays 16.5% copper.

In reporting on the recent discoveries of manganese ore on Vancouver Island, W. M. Brewer, resident engineer, states that the deposits in question are, in his opinion, of considerable importance. As there has been little development done their extent is undetermined. Samples assayed by the Provincial Bureau of Mines show between 15.88 and 52.60% Mn, the majority of the samples yielding over 40%. G. C. Mackenzie, Western representative of the Munition Resource Commission, considers 2000 tons is immediately available. It is stated that the deposits occur in a belt of cherty jasperized rock, which is said to be continuous from Mt. Sicker to the northerly end of Cowichan lake, a distance of 40 miles, and is included in the Mt. Sicker series of rock formation. Sufficient work has not been done to determine whether the deposits are residual or are replacement deposits in the jasperized rock, and occupy fissures in the sheared portion of the belt of rocks. The latter theory would appear, from the conditions at present shown by the shallow work that has been done, to be the most tenable; and if such prove to be the case it is reasonable to presume that the ore deposits may possibly persist to considerable depth, as the shearing movement appears to be widespread and deep-seated.

It is stated in Vancouver that, despite the efforts of the United States authorities at the border, American gold continues to come into Canada for barter and exchange, especially among the Chinese, who pay as high as 35% premium for coinage. This in turn, it is claimed, is shipped out of Canada to the Orient. During recent months the price for gold among the currency gamblers in the Oriental quarter of Van couver has increased from 10 to 30%.

TORONTO, ONTARIO

Porcupine, Boston Creek, and Matachewan.

Porcupine.—The Dome Mines company is preparing for a greatly increased output as soon as milling is resumed. Ore already broken underground amounts to over eight months supply for the mill, which has a capacity of 40,000 tons monthly. Waste-pockets and ore-loading stations have been cut on the 960 and 1200-ft. levels. Lateral work is under way at 1000, 1150, and 1200 feet.

Boston Creek.—Four veins have been found in the Knox claims near the Miller-Independence. The largest, 4 ft. wide, which promises well, has been uncovered for 400 feet.

At the Miller-Independence some exceptionally rich ore has been opened. In addition to a pay-streak 4 to 5 ft. wide, in which telluride of gold occurs in large quantities, the vein has 6 to 8 ft. of high-grade milling ore.

Development at the O'Donald has uncovered a rich vein, traced for 400 ft. to the Patricia boundary. It is thought to be a continuation of the main vein of that property.

A vein recently opened on the Cotter carries visible gold and tellurides. An extension of this vein is found on the Cullen-Renaud claims.

Matachewan.—It is officially stated that the extensive diamond-drilling done on the Otisse has been satisfactory, indicating a large quantity of milling ore. Work has been suspended owing to the difficulty and excessive cost of transportation, but as soon as the winter roads are suitable a first-class mining plant will be taken in. The Colorado Ontario Development Co. which now owns the property, will be taken over by a new company known as the Matachewan Gold Mines, Ltd., capitalized at $4,000,000. Prominently identified with it are Charles Flynn, C. A. Foster, and Walter J. Boland, members of the old company.

ARIZONA

Dos Cabezos.—The Mascot Copper Co. has issued its report for the year ended August 31, 1918. The financial situation is unsatisfactory, while no figures of ore-reserves are given. In April 1917 the A. S. & R. Co. took a 20-year lease on the property, but cancelled it in February 1918. This found the company with a developed and equipped mine but no funds. The president, T. N. McCauley, personally advanced $42,000, and on August 31 he was owed $63,078. Current assets total $64,911, plus $9279 cash. Current liabilities amount to $74,164 for loans and interest, plus $44,269 for sundry credits. The company owns a 15-mile railway, running between the terminal of its 2-mile aerial tram and the Southern Pacific line at Willcox. There was $217,588 spent on this road. The report states that over $3,000,000 has been spent in development and equipment. The plant includes two 250-hp. Union gas engines, two Ingersoll-Rand compressors, dynamo, machine-shop, machine-drills, diamond-drills, assay-office, aerial tram, automobiles, and 90 buildings. Fifteen holes are said to have found 23 new orebodies. On August 20, 1918, the directors asked shareholders to contribute 1c. per share. The 1,000,000 $10 shares issued are non-assessable. During the year under review there was 1218 ft. of development done. This brings the total to 27,427 ft., plus 28,101 ft. of drilling. The general superintendent, J. W. Prout, Jr., considers that the geologic conditions are intricate. He has planned for 2500 ft. of work above the 450-ft. level. During the year, 13,276 tons of 3% copper and 0.5 oz. silver ore was sent to the smelter. The gross value was $147,896. There does not appear to have been any profit from this, as the balance-sheet shows none. From September 1915 to October 1918 there was smelted 32,182 tons of 3.17% ore, also 0.5 oz. silver per ton. Its gross value was $425,172, less freight and smelter charges. The local treatment of the ore is considered advisable. The ore carries 25% silica and alumina, also 40% iron. Experiments suggest magnetic separation and wet concentration, the concentrate to be roasted and leached, recovery of the copper to be by electrolytic methods.

Dragoon.—It is reported that a 5-ft. vein of gold ore, assaying $130 per ton, has been opened in a property paralleling the Gold Ridge mine in the Dos Cabezos district. The ore is being hauled by mule-team to the Golden Rule mill, four miles from Dragoon.

Duncon.—The Duncon Mining & Milling Co. has commenced operations at Mount Royal, and proposes to erect an 80-ton concentrator.

Quartzsite.—A gold discovery of considerable importance is reported from the Pluamos mountains, 15 miles from Quartzsite, near New Water springs.

Tucson.—J. A. Chapman of Columbia, Tennessee, and C. F. Hagedorn of Chicago, have brought suit in the Superior Court to obtain the return of $20,000 lent by them to the Daily Arizona Consolidated Copper Co. to purchase additional claims. It is alleged that the loan was secured by misrepresentation.

Wickenburg.—The Octave Mining Co. has commenced construction of a 250-ton stamp-mill. Mining has been carried on during the past three years, and sufficient ore is available to warrant the mill.

Ray.—The third quarterly report of Ray Consolidated shows the following, compared with the previous period:

	Third quarter	Second quarter
Profit	$ 883,348	$2,255,217
Dividends	1,182,884	1,182,884
Surplus or deficit	−$299,534	+$1,072,333
Development, feet	10,418	14,420
Cost of mining, per ton	$1.865	$1.621
Ore milled, tons	845,400	881,800
Copper content, per cent	1.602	1.643
Recovery, per cent	75.18	75.81
Cost of milling, per ton	1.133	0.978
Copper output, pounds	20,358,589	21,963,414
Cost per pound, cents	20.283	16.468

Wages, smelting and refining rates, supplies, and a decrease in efficiency were the causes of the higher costs.

CALIFORNIA

Idria.—Fire that did considerable damage in No. 2 workings of the New Idria company is under control.

Mineral King.—It is reported at Visalia that there is a revival of interest in this old district, which is 55 miles east. Lack of transportation facilities is against exploration.

Red Bluff.—Like many others, the Tedoc chrome mine has suffered from the chrome market. The superintendent, J. H. Hart, states that the company spent $34,000 in constructing 12 miles of road this season. Operations came out about even. Ore was sold as high as $76 per ton, but now it only realizes $36. About 3000 tons was extracted this season, and 200 tons is in bins awaiting transportation.

Redding.—The chrome mines on Beegum creek, 55 miles south-west, over the line in Tehama county, have been shut-down for the winter, condition of roads making it impossible to haul ore to rail.

San Jose.—Manganese ore worth $10,923 has been sold by this city from the so-called meteor in Alum Rock park. The cost of mining was $500. Owing to lack of demand, extraction has been suspended.

Trinity Center.—The main shafting for the Estabrook dredge, a steel casting weighing 23,000 lb. (16 ft. long and 24 in. diameter), has been taken from Redding to the site. A caterpillar engine of 75 hp. was used in hauling the logging-truck on which the heavy piece was loaded.

COLORADO

Boulder.—Shareholders in the Boulder Tungsten Production Co. are said to be dissatisfied with the condition of the company. When the price of tungsten dropped in 1916 the company was completing its ferro-tungsten refinery and had established a market for its output. The finances were crippled to a serious extent, rendering it necessary to curtail development and retrench to the utmost. This was done, and the only activity of the company was confined to work in the mines on orebodies that were opened and in sections where lease operators had good prospects of new discoveries. Under this policy the mines were being gradually brought to an increasing production basis and revenues from lease output gave funds to support more pressing claims. Revival in the tungsten market and a steadily advancing price

gave promise in recent months that the company would soon be re-established to a position to conduct its business on the broader and more aggressive scale which so perfectly organized an investment demanded, according to the Boulder county 'Miner'. At this stage, however, impatient stockholders began to be importunate, and, headed by Mrs. Tindolph, daughter of the late J. N. Williams, one of the original incorporators and a member of the board of directors, began court proceedings to force matters to issue in an attempt to realize from their holdings. The management early tendered them control of the company and the full management, provided they would furnish funds for the relief of the company from its obligations and with which to enable it to proceed with the development of its mines and maintenance of its tungsten manufacturing enterprise. This they were not prepared to do, but persisted in agitating discontent among the stockholders. A meeting was called to be held at Chicago last week, at which definite steps to secure the appointment of a receiver were reported to be planned. Those acquainted with the company recognize that such action at this time will precipitate the troubles of the company and work directly into the hands of the powerful influences that have at all times been directed against this independent factor in the practically monopolized tungsten industry, and would undoubtedly result in the disintegration of the company and the loss of its mineral holdings. The manager, J. G. Clark, has the support of a great majority of the stockholders.

Cripple Creek.—The lessee of the Stratton Cripple Creek M. & D. Co.'s Keener tunnel dump, H. Von Phul, is shipping 70 tons of $5 to $6 ore every other day to the Portland company's Independence mill.

Rico.—Alunite is reported as being developed in this district.

MICHIGAN

Houghton.—Stocks of copper are low at every smelter in this district; in fact, no metal is being put in storage, and the close of navigation finds every dock cleaned up. Shipments by rail, many by express, and by preferred freight, continue to go East.

Copper Range Company pays $1.50 per share, equal to $585,504. This makes $6 for the current year.

Calumet & Hecla reports as follows for October, in pounds:

Mine	October	10 months
Ahmeek	1,951,655	21,316,285
Allouez	529,859	6,075,712
Calumet & Hecla	5,859,296	57,398,092
Centennial	249,200	2,101,562
Isle Royale	1,461,207	12,523,205
La Salle	119,857	1,570,962
Osceola	1,217,910	13,515,753
Superior	78,715	1,470,571
White Pine	462,230	2,517,054

Isle Royale is now producing from six shafts, and its tonnage will be increased to 5000 tons daily within a year, if the labor situation permits. The present output is 3700 tons. Twelve electric locomotives are at work and eight more will be added as soon as they can be secured. The Isle Royale mill at Houghton is dressing 2100 tons daily, including Sunday. Tonnage to the No. 1 Lake mill at Point Mills has been as high as 1800 tons and as low as 500 tons, but is averaging between 28 and 30 carloads. Three stamps at Point Mills are at the service of the Isle Royale company, and a fourth is being arranged. More men are coming to work at the Isle Royale every day. The Government work at Senter is not as attractive as it was when operations started. That work took a good many Isle Royale men.

MISSOURI

Joplin.—Production of the Tri-State region last week totaled 4470 tons of blende, 860 tons of calamine, and 1089 tons of lead. These averaged $52, $39, and $100 per ton, respectively. The total value was $408,001, making $22,846,709 to November 16. Missouri contributed $114,401 to last week's output.

The market was light and unsatisfactory, according to the 'News Herald'. There is estimated to be a surplus of 18,000 tons of blende in the region. A hundred producers met at the Connor hotel on the 16th, and the following resolution, prepared by a committee composed of Edgar Wallower, C. F. Dike, and Temple Chapman, was adopted by the operators:

"Whereas, the zinc-ore buyers in the Missouri, Kansas, and Oklahoma district are purchasing less than one-half of the present output of the district, and there is now sufficient surplus tonnage in storage to supply the limited demand for some time.

Resolved, That the mine operators of the Missouri, Kansas, and Oklahoma district, assembled at the Connor hotel, Saturday, November 16, 1918, agree to shut-down the mines of the district, provided that 60% of the tonnage of the district sign this agreement, this shut-down to remain effective until the surplus tonnage of ores in the district shall have been absorbed, and the operators in session agree to a resumption of production."

Waco.—At the Blue Rock lease, owned by the Crescent Lead & Zinc Co., 9 of 14 drill-holes have cut good ore, three assaying 20%. One shaft is down 101 ft. and another 142 ft. The ore extends from 185 to 255 ft. A 200-ton mill is being erected. It will be driven by oil-engines. Glenn Smith is in charge.

MONTANA

Butte.—Davis-Daly pays 25c. per share, equal to $150,000, on December 30.

The Anaconda company is reported to have suspended mining of manganese ore at the Emma. About 10,000 tons monthly was extracted, 8000 tons going East and the remainder to the ferro-manganese plant at Great Falls. The Butte-Detroit Copper & Zinc Co. is concentrating manganese ore. It will continue this work, as it has a large contract with the U. S. Steel Corporation.

Federal agents have been making an investigation into copper-production problems and labor conditions at Butte, according to the 'Miner'. Scott Leavitt, of Great Falls, special agent of the Department of Labor, who has been assigned to this district for that purpose, held a series of conferences on November 15 with mining operators and labor representatives.

Federal officials declare that the I. W. W. of Butte have failed in another attempt to curtail copper production. At a meeting of the I. W. W. local No. 800, held on November 18, unexpected opposition to a strike proposal developed. As a result, the organization was divided into two factions, one desiring and the other opposing a strike. The radical element, it is said, desires abolition of the rustling-card and $6 for an eight-hour day. Mining operators declare that I. W. W. propaganda has been circulated among the miners and numerous acts of sabotage have been committed. Scott Leavitt, State Director of Labor and special representative of the Federal Department of Labor, continued his investigations, and held conferences with the mining operators and labor representatives. He stated that he was at Butte under a special commission from the Secretary of Labor to act as his special representative in attempting to bring about the largest degree of co-operation and feeling of confidence on the part of the employees in the Butte copper industry, and by establishing and supervising a certain measure of the control over employment in such industry.

Kendall.—Barnes-King Development Co. paid dividend No. 7, of $40,000, on November 15. This makes $260,000

to date. The report for the third quarter of 1918 shows a profit of $55,704 for the period. The total revenue was $183,942. The balance from the second quarter was $213,817, and that carried forward $185,664, which is cash and bullion. Production was as under:

Mine	Tons	Value per ton	Profit
Kendall	3,680	....	$1,388
North Moccasin	5,580	$8.59	8,853
Piegan-Gloster	3,446	8.07	.....
Shannon	5,924	17.61	61,736

In the Shannon there is now an ore-shoot 300 ft. long in the 500' west drift. This has not been opened on other levels yet. Results in the Mt. Pleasant mine were fair. The October gold yield of the properties was $36,000.

NEVADA

Goldfield.—The Spearhead company reports that the ore-shoot on the 910-ft. level persists, and assays $95 per ton. Shares rose from 2 cents, the price two weeks ago, to 9 cents. Other Goldfield shares improved.

Silver Peak.—A lease for 20 months has been granted to D. Trepp and M. Chiaovich on the Treasure State claims at Indian Garden, 16 miles south of Silver Peak. The ore carries silver and lead.

Tonopah.—Production of the district lately has been as under:

Week ended	Tons	Value
October 26	9,265	$157,505
November 2	8,839	150,263
" 9	8,582	145,984
" 16	6,311	107,287

October yields of some of the mines were as follows:

Mine	Tons	Silver, oz.	Gold, oz.	Profit
Belmont	9,968	116,378	1,185	$64,858
Jim Butler	1,054	.....	....	5,943

The Extension is sinking from 1760 to 1810 ft. A turbine-pump is to be lowered from the 1680 to the 1760-ft. station.

The Tonopah Mining Co. has cleaned-up all of its low-grade dumps, the ore being treated at a profit. The metallurgical department is investigating whether the old sand dumps at Millers can be treated profitably. This product was leached by cyanide.

OKLAHOMA

Miami.—In Oklahoma the Robert W. Hunt Engineering Co. controls the Pittsburg-Miami, Zinc-Lead Corporation, and Producers company. At the first, water has delayed starting of the new mill. The workings are 270 ft. deep. The second is north of Tar River. Sixty drill-holes were put down in a 40-acre lease. A 300-ton mill shows the ore to carry 6% blende and lead. A shaft is being sunk at the Producers.

Picher.—Production of the fields last week amounted to 3100 tons of blende and 869 tons of lead, valued at $275,300.

UTAH

Bingham.—Utah Copper reports as under for the third quarter of 1918, compared with the second period:

	Third quarter	Second quarter
Profit from operations	$4,169,698	$5,483,813
Dividends received, etc.	1,140,314	1,009,564
Total profit	$5,310,002	$6,493,377
Dividends paid	4,061,225	4,061,225
Surplus	$1,248,787	$2,432,152
Capping removed, cubic yards	1,082,280	1,167,515
Ore milled, tons	3,412,700	3,201,900
Copper content, per cent	1.2004	1.2535
Recovery, per cent	65.07	64.49
Copper output, pounds	54,739,678	52,724,053
Cost per pound, cents	16.814	15.047

Increases in smelting and refining, freight, and wages resulted in the above higher costs.

NEW MEXICO

Santa Rita.—Chino Copper reports the following for the third quarter of 1918, compared with the second:

	Third quarter	Second quarter
Net profit	$1,035,749	$1,916,513
Dividends	869,980	869,980
Surplus	$ 165,769	$1,046,533
Overburden moved, cubic yards	773,776	940,057
Ore milled, tons	932,000	901,500
Copper content, per cent	1.6233	1.5773
Copper recovered, pounds	19,449,195	19,030,992
Cost per pound, cents	19.08	16.36

The higher cost is largely due to increased wages and sup-

DIAMOND-DRILL (SULLIVAN) AT BOTTOM OF NO. 3 SHAFT—980 FT. BELOW MAIN ADIT AND 1750 FT. BELOW THE OUTCROP OF MOGOLLON MINES CO., MOGOLLON, NEW MEXICO

plies, higher charges for smelting and refining, and increasing the charge for absorption of stripping expense into operating cost to 45c. per ton of ore milled.

WASHINGTON

Loon Lake.—The Loon Lake Copper Co., operating 50 miles north of Spokane, is floating a bond issue of $90,000 with which to build a mill. In the meantime ore from the mine is being shipped steadily by a lessee.

Two other properties are active in this locality. They are the Loon Lake Blue Bird and the Spokane Copper. The former company has installed a compressor and added a boiler and other equipment. The Spokane Copper is pushing development, having opened an excellent vein on the 110-ft. level.

CANADA

British Columbia

Rossland.—This centre has been severely hit by influenza. The mines are closed, and even the daily newspaper has ceased publication.

Stewart.—The community has suffered severely from influenza. With insufficient drugs, etc., and no doctor immediately available, patients not only were without skilled professional attention, but could not be given anything more than personal care. This was provided by the miners and prospectors of the surrounding districts, who suspended work for the purpose, all of the town being ill. In a mining way Stewart seems to be flourishing, local miners predicting that it is going to prove an extensive producer. The Bush property near Cascade creek, recently acquired from a New York syndicate by R. K. Neill, of Spokane, is spoken

of most optimistically. Mr. Neill is making arrangements for the transportation of ore this winter. The Nesbitt, George, and Lesley properties also are mentioned, and a new company was incorporated recently to work the latter group.

Surf Inlet.—The Belmont Surf Inlet Mines has milled 52,920 tons of ore, yielding $518,774, during the 6 months ended August 31. The profit was $179,171. The monthly tonnage has been up to 9407.

Ontario

Cobalt.—Subscriptions by mining companies to the Victory Loan are as follows:

Nipissing	$1,000,000
Kerr Lake	500,000
Temiskaming	400,000
Coniagas	90,000
Buffalo	50,000
McKinley	50,000
Trethewey	25,000
Total	$2,115,000

MEXICO

Mexico City.—Telegraphic advice from Mexico City to the United States, under date of November 13, stated that President Carranza had on that date signed a decree reforming the monetary system of Mexico by placing it on a strictly gold basis. The recent monetary crisis was caused by the exportation of silver half-peso pieces, which as the result of the high price of silver were worth more as bullion than as coin. Business has been seriously handicapped for a fortnight by the scarcity of change. Under the new decree peso and half-peso pieces will be coined with less silver in them, making their exportation profitless. New gold coins now being minted are worth two and a half pesos. Millions of pesos in silver and half-peso pieces, called 'tostones,' recently disappeared from circulation. These have been demonetized to prevent speculation in the new pesos. It will be illegal for any one to give more than twenty pesos of them as change.

The U. S. War Trade Board has issued the following note for exports from the United States to Mexico: In view of the increasing scarcity of many commodities of prime importance and necessity to the United States, which at the same time this Government desires to share with Mexico, it has become necessary for the Board to allot such commodities for export to Mexico, in order to equalize the distribution throughout the neighboring Republic in an equitable and orderly manner, consistent with the maximum amount of such commodities as can be spared. Prospective importers in Mexico will facilitate the granting of licenses for export by the Board by presenting copies of their orders for supplies in triplicate to the nearest American Consular officer, who will vise such orders and retain one copy for his file, returning the original and one copy to the applicant. The importer should forward both viséd orders to the prospective exporter in the United States, with instructions to attach the original viséd order to his application to the War Trade Board for an export license covering the commodity specified in such order, or file the original viséd order with the Board at Washington, and thereafter, in filing applications for licenses to export the commodities specified on such order, refer to the order by the Consulate stamp serial number, which will be affixed to the order, and also the Consular address, as 'Mazatlan, Serial No. 4782.' In cases where American Consular officers are not easily accessible to the prospective importer, a statement to that effect should be attached to the order, giving the name of the nearest place where a Consular officer is stationed.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

George H. Garrey is at Tonopah, Nevada.

Charles Janin has returned from Washington.

Charles W. Stimpson, of Salt Lake City, is at New York.

F. Le Roi Thurmond, of Anchorage, Alaska, is now at Seattle.

Clarence Woods has moved from Virginia to Dragoon, Arizona.

J. F. Abbema, of Oakland, is now with the Cinco Minas company in Jalisco, Mexico.

George O. Bradley is expected in San Francisco on his return from British Columbia.

Robert Hay Anderson has gone to New York, expecting shortly to return to Mexico City.

C. Terry du Rell has been commissioned Captain of Engineers with the 403rd Engineers at Fort Douglas.

Arthur Feust, who is now at Chicago, is working with the Industrial Survey branch of the War Industries Board.

George S. Backus, formerly of Leadville, Colorado, is now with the Minerals Separation American Syndicate, Ltd., in San Francisco.

John W. Moule has left the Great Cobar company to become assistant manager for the Burma Corporation, Ltd., at Namtu, Burma.

E. A. Cappelen Smith, consulting metallurgical engineer to the Chile Exploration Co. and Braden Copper Co., has been elected vice-president of both companies.

Frank H. Probert, Professor of Mining in the University of California, has been appointed a member of the National Committee on Minerals and has gone to Washington.

Walter V. Fox is now general manager for the War Mining & Milling Co., operating a zinc mine and plant at Lincolnville, Oklahoma, and a gold property near Idaho Springs, Colorado.

F. L. Longworth, until recently smelter superintendent for the Canada Copper Corporation, at Greenwood, B. C., has become superintendent of the Tennessee Copper Co.'s smelter at Copperhill, Tennessee.

Lee B. Davenport, for eight years in charge of the Goldfield Consolidated refinery, at Goldfield, Nevada, has resigned, on account of the altitude, and is now at Oakland, California.

Obituary

H. P. Corliss, the discoverer of alpha-naphthalamine as a flotative agent, died of pneumonia, after influenza, at Ray, Arizona, on November 16. He was a brilliant technician and gave promise of being greatly useful to the metallurgical development of the flotation process.

Bruce White, pioneer mine operator in British Columbia, is a victim of the influenza epidemic. Mr. White was one of the discoverers of the Slocan Star mine, later known as the Silversmith, from which over $3,000,000 in ore has been taken. At the time of his demise Mr. White was manager of the Noonday Mines at Sandon, B. C.

Frederick A. Hale Jr. died of influenza at Good Springs, Nevada, on November 17. He was a native of Denver and only 31 years old. A graduate of Stanford University and of the Utah University Mining School, he had proved himself a capable engineer both in Idaho and Nevada. He was manager of the Yellow Pine Mining Co., a profitable zinc producer.

THE METAL MARKET

METAL PRICES

San Francisco, November 26

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	11.00
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	8.30—8.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	11.00
Zinc-dust, cents per pound	16.00

The War Trade Board announced on November 19 the removal from the export conservation list, effective at once, of dental platinum, iridium, palladium, platinum, and rhodium. The New York Assay Office handled the entire platinum requirements of the Government during the War, nearly 60,000 oz. being dealt with.

ORE PRICES

November 26

Chrome, no definite quotations available.	
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.25
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$26

The War Trade Board announced on November 9 that all outstanding licenses for the importation of chrome ore, except those covering shipment from Cuba, Canada, and Brazil, are revoked as to shipment from abroad after November 11. Hereafter no licenses will be issued for the importation of chrome ore, except licenses covering shipments from Cuba, Canada, and Brazil.

EASTERN METAL MARKET

(By wire from New York)

November 26.—Copper is quiet. Lead is firm. Spelter is more active and stronger.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 49½ pence.

Date	New York,	London
Nov. 20	101.12	49.50
" 21	101.12	49.50
" 22	101.12	49.50
" 23	101.12	49.50
" 24 Sunday		
" 25	101.12	49.50
" 26	101.12	49.50

Average week ending	
Oct. 15	101.12
" 22	101.12
" 29	101.12
Nov. 4	101.12
" 12	101.12
" 19	101.12
" 26	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	....
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York.

Date	
Nov. 20	8.05
" 21	8.05
" 22	8.05
" 23	8.05
" 24 Sunday	
" 25	8.05
" 26	8.05

Average week ending	
Oct. 15	8.05
" 22	8.05
" 29	8.05
Nov. 4	8.05
" 12	8.05
" 19	8.05
" 26	8.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.22	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	....
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date	
Nov. 20	26.00
" 21	26.00
" 22	26.00
" 23	26.00
" 24 Sunday	
" 25	26.00
" 26	26.00

Average week ending	
Oct. 15	26.00
" 22	26.00
" 29	26.00
Nov. 4	26.00
" 12	26.00
" 19	26.00
" 26	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.69	23.50	Nov.	31.95	23.50	....
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date	
Nov. 20	8.50
" 21	8.55
" 22	8.60
" 23	8.65
" 24 Sunday	
" 25	8.65
" 26	8.70

Average week ending	
Oct. 15	9.02
" 22	9.08
" 29	9.04
Nov. 4	8.96
" 12	8.91
" 19	8.62
" 26	8.61

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16.01	9.41	7.29	Nov.	11.81	7.76	....
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefore $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date	
Oct. 29	120.00
Nov. 4	120.00
" 12	120.00
" 19	120.00
" 26	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	319.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110.00	Nov.	79.50	102.50	....
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	78.82
May	49.10	63.21	100.01	Nov.	44.12	74.18	....
June	42.07	61.93	91 00	Dec.	42.55	85.00	....

ORES (New York)

Antimony: No development in this ore.

Molybdenite: This market is also quiet with no demand to gauge the idea of buyers and sellers.

Manganese Alloys: At a meeting last week of ferro-manganese producers in New York it was agreed to maintain indefinitely the price of 70% alloy at $250, delivered. Spiegeleisen, 16%, is quoted now at $70, furnace. There is hardly any demand for either. After January 1 all restrictions recommended last May as to 70% ferro and 16% spiegel being regarded as good delivery on all contracts for standard grades, have been withdrawn by the Committee on Steel and Steel Products.

Tungsten: A meeting of the tungsten interests was to be held in New York on November 25. The market is quiet and there has been no list of prices.

Eastern Metal Market

New York, November 20.

The assurance of peace has caused no flurry in the markets, demand being light in the open markets and no excitement in those under control.

Copper prices and conditions are to remain as they have been until January 1.

Tin is practically a controlled market, with the major part of the buying done by one company. Outside of this there is little buying.

Lead continues under control as to distribution and prices.

Zinc is an open market with demand light and prices lower.

Antimony has again declined.

In the steel trade the whole scheme of priorities, apart from those on merchant ship, railroad, and navy material, has been abrogated by the authorities at Washington; and thus there is restored at one stroke a substantially free market. Cancellations of war work have appeared extensively. The industry, however, is hopeful for several reasons; but it is not yet certain whether sufficient new orders will come in during the next month or two to make good the depletion. The 40,915 cars and 1500 locomotives ordered last month for the American forces in France have been cancelled, and about 300,000 tons of rails for the same purpose have been held-up. There have been numerous cancellations of shell-steel and wire. The British policy is to stop everything that is not more than 90% finished and to realize on it at its scrap value. A mutual sentiment in favor of continued co-operation developed at the meeting in Washington last week of steel-makers and the War Industries Board, but the attitude of the railroad administration not to buy further until prices are lower was a disappointment.

COPPER

The situation as to prices has been settled until January 1 by an agreement entered into last week in Washington between the War Industries Board and the copper producers. It was also agreed that there should be no reduction in wages nor any slackening of output. Whether there will be an open market after that is a question. So far there are no reports of cancellations, and there is little expectation of any, particularly from allied countries. It is probable that the latter contracts can be applied to non-war uses. There has been no rush to buy copper from foreign sources, this being regarded as natural, for no matter how great the probable need there has been no chance to gauge this definitely. Unconfirmed rumors are to the effect that electrolytic copper has sold lower than the fixed price for delivery after January 1. Lower than the established price continues to be quoted for casting copper.

TIN

The only news feature of interest during last week has been the presentation yesterday to the War Industries Board at Washington by the Tin Importers' Association, Inc., of an alternative plan for controlling importation and sales of tin in this country. The feature of this plan is that the business would still be conducted by the present importers under licenses, the distribution being made through some such agency as the American Iron and Steel Institute. In this way the transition from war to peace could be easily conducted, and still the trade not be in the hands of the largest consumer of tin in the country. The Board has the matter under consideration. Buying of tin for future requirements on any scale is now being done under the new international control. American consumers are purchasing through the United States Steel Products Co., which purchases and sells the metal at cost, the distribution being through the American Iron and Steel Institute. Outside of this buying, which has probably been large, there is little demand for such resale lots in transit or arriving as are available. There is almost no open demand, and the price for spot delivery remains nominal at about 75c., New York. Importers are practically out of the business, except as they are granted licenses to import tin to fill contracts entered into prior to October 1. Tin arrivals thus far this month at Pacific ports have been 1125 tons, with 100 tons at Atlantic ports. In London spot Straits has fallen to £317 per ton, a decline of £17.

LEAD

Peace has had no effect on this market so far. It is realized that supplies are by no means ample, and that any relaxation of control would probably result in a decided advance in quotations. The Lead Producers' Committee continues to regulate sales and distribution with the price fixed at 7.75c., St. Louis, or 8.05c., New York. While some consumers expect a decline from these levels, there seems little likelihood of it for some time. The present control, which is voluntary and not Governmental, is expected to continue until early in 1919.

ZINC

This market has been uncontrolled throughout the War except, as to special grades, and has so far withstood the effect of the cessation of hostilities unusually well, and is regarded as a reflection of what might be the case in other markets. There has been no decided break in prices. As might be expected, demand has not been large since the armistice was announced. Prices eased-off gradually until yesterday prime Western was quoted at 8.15c., St. Louis, or 8.50c., New York, for early or November delivery, with December shipment held at 7.95c., St. Louis, or 8.30c., New York. For first quarter the nominal quotation is about 7.75c., St. Louis, or 8.10c., New York. Grade A zinc is still held at a maximum price of 12c. per lb. base. It could probably be bought considerably under this. Sheet-zinc has a maximum Government price of 15c. per lb., with plate-zinc at 14c. per pound.

ANTIMONY

The effect of peace continues to be felt in this market. It has declined again to 9 and 8.25c. per lb., duty paid, New York, for wholesale lots for early delivery. It is stated that sales have been made for delivery in January and February at 7.75c., New York, duty paid.

ALUMINUM

This market continues to be ruled by maximum Goverament prices, effective until February 1. For No. 1 virgin metal and for scrap in 50-ton lots, 33c. is the quotation, with 33.10c. per lb. asked for 15 to 50-ton lots, and 33.20c. per lb. for 1 to 15-ton lots.

The production of steel ingots in October, according to statistics compiled by the American Iron and Steel Institute from reports submitted by 29 companies, which made 85.10% of the total production of steel ingots in 1917, was at an annual rate of production of 46,699,360 tons, exceeding the revised September rate of production of 46,443,070 tons per year by 256,290 tons.

Company Reports

CRESSON CONSOLIDATED GOLD M. & M. CO.

Property: at Cripple Creek, Colorado.

Operating Officials: A. L. Blomfield, general manager; Luke Shepard, mine superintendent; L. S. Noble, consulting engineer.

Financial Statement: During the year ended August 31, 1918, the net revenue from ore sales was $1,628,188, plus $23,495 from royalty and interest. The profit was $1,205,386.

Dividends: 10c. per month was paid, equal to $1.20 per share, or $1,464,000. The total to date is $7,027,163.

Development: drifts, etc., totaled 8238 ft., plus 4540 ft. of diamond-drilling, and 886 ft. of work to connect the main shaft and the 1603 orebodies with the Roosevelt drainage-tunnel. The most interesting features resulting from the year's operations are: (1) Discovery of new orebodies on the third, fourth, and fifth levels on the vein systems of the Funeral and Sliver dikes; (2) discovery of new orebodies of substantial size and value on the seventh, eighth, ninth, and tenth levels, in the centre of the volcanic crater (the past development and ore discoveries in the eruptive area have all been limited to the contact or exterior boundaries of the crater); and (3) discovery on the Roosevelt tunnel-level of orebodies on the downward extension, and increase in size and value of the ore measures heretofore disclosed on the sixteenth, or deepest level of the Cresson, 175 ft. above the tunnel. Ore-reserves on August 31 were estimated as worth $2,948,489.

Production: there was shipped 89,730 tons of ore, valued at $24.14 per ton. Lessees produced 1599 tons, which gave a royalty of $2539.

Costs: the increase amounted to about 60%.

DAVIS-DALY COPPER CO.

Property: 320 acres under the city of Butte, Montana.

Operating Officials: W. L. Creden, general manager.

Financial Statement: in the year ended June 30, 1918, the income was $1,400,219, mostly from ore sold. Expenditures totaled $818,081, leaving $582,138. Deductions and additions left a net profit of $457,490. Current assets totaled $522,205, and liabilities $69,929.

Dividend: an initial of 50c. per share was paid, equal to $300,000.

Development: Labor troubles have given the management the greatest concern, and at the present writing (October 9) no improvement is in sight. Wages have been increased, and with almost 100% increase in price of supplies, operating costs have advanced accordingly. Ventilation has been no small item of expense. Heat on the lower levels has been intense. Arrangements were made in December 1917 to connect by cross-cut the Colorado shaft with that of the Belmont of the Anaconda company. The distance between the two shafts is approximately 2500 ft., advance is slow, as the temperature in the cross-cut is 100°. Large and powerful fans are being put in the lower levels as a part of a permanent ventilating system. New equipment has been installed at the Colorado, notably a new electrically-driven hoist and compressor. Extensive improvements are contemplated that will facilitate mining and lower costs of production. Operations at the Hibernia have been active. This is primarily a silver-zinc mine, but it contains large quantities of manganese. Mining of this ore was undertaken for a period, but on account of inability to secure acceptable treatment of the ore production was stopped. Sinking the Hibernia shaft to the 600-ft. level was discontinued owing to the large inflow of water, which proved to be troublesome and expensive. This shaft has been equipped with an electrically-driven hoist and compressor. No coal is used at this plant. Questions of apex have arisen with the neighbors of the Hibernia, which means long and expensive development to prove the Davis-Daly claims, but the management is confident of the final outcome. One significant fact for the year with the Davis-Daly is its emerging from a developing mine to a producer.

Production: the two mines yielded as under:

	Colorado	Hibernia
Ore, tons	52,996	5,724
Copper, pounds	5,894,396	.....
Zinc, pounds	.....	1,316,310
Lead, pounds	.....	611,907
Silver, ounces	260,672	129,816
Gold, ounces	.....	356

The average grade of the copper ore was 6.597%.

ORIENTAL CONSOLIDATED MINING CO.

Property: mines and mills in the Unsan district of Korea.

Operating Officials: Alf Welhaven, general manager; T. W. Van Ess, assistant; J. B. Lower, superintendent of Tabowie, Taracol, Maibong, Chintui, and prospects; J. A. Vernon, assistant at Chintui and prospects; E. S. Barstow, superintendent of transportation; W. H. Aldridge, mechanical engineer; E. H. Emerson, electrical engineer; K. F. Hoefle, superintendent of fuel and timber railway; E. L. Power, medical officer; A. B. Palmer, cashier; C. A. Crispin, auditor; S. E. Iijima, secretary to general manager.

Financial Statement: revenue during the year ended June 30, 1918, totaled $1,528,525. Of this, $393,464 was profit. The surplus on June 30, 1917, was $230,684, and a year later $409,453, after paying dividend. Assets include cash in banks, $531,114; supplies, $453,514. Sundry debtors total $222,799.

Dividends: No. 36, amounting to $214,695, was paid in September 1917. This made $7,938,645 to that date. Since then another distribution has been made.

Development: in the five main mines a total of 34,697 ft. was done, 3000 ft. short of the previous year. On prospects, 1226 ft. was accomplished. Results at the Tabowie were unsatisfactory and discouraging; at the Taracol and Chintui satisfactory and encouraging; the Charabowie was worked out, while the Tongkol was not as good as expected. Work on outside areas was generally unsuccessful. Ore-reserves total 775,000 tons, valued at $5.27 per ton. The Tabowie contains 485,000 and the Taracol 238,000 tons.

Production: three mills—the Tabowie, Taracol, and Maibong—with 200 stamps, crushed 303,672 tons of $5.90 ore. The Maibong was shut-down permanently in July 1918. By amalgamation there was $845,142 saved. Concentrate treated at the Tabowie and Taracol plants amounted to 27,462 tons, yielding $600,729, or 83.2%. The Maibong tube-mill plant treated 2060 tons for $45,933, the recovery being 91%. The total extraction of gold was $1,493,318, equal to 90.3% of the gross value of the ore. Since work first started the yield has been $29,423,235 from 4,766,270 tons of ore.

General: total receipts were $5.03 per ton, operating costs $3.06, and construction 10 cents, leaving a profit of $1.87 per ton. The hydro-electric plant worked 342 days, generating 588 hp. per day. Okura & Co.'s power supply was unsatisfactory, and has been discontinued. The Oriental Consolidated has now to construct a plant to cost $425,000. This will enable lower-grade ore to be treated more profitably than at present. The rainfall was 66 inches. The forestry department planted 220,000 trees of various kinds. The Taracol free bath-house continues to be popular, 88,862 baths being taken during the year. The medical staff gave 20,813 treatments, 13,512 being company employees. A charge of 5 cents to outsiders kept away many idle curious. The report, as usual, is full of interesting cost data.

Book Reviews

Mineralogy, Blowpipe Analysis, and Crystallography. By G. M. Butler. Pp. 546, ill., charts, indexes. John Wiley & Sons, New York, 1918. For sale by 'Mining and Scientific Press'. Price, $3.50.

This new work consists of three books in one, namely: 'A Pocket-Book of Minerals', second edition, of 311 pages; 'Handbook of Blowpipe Analysis', first edition, of 80 pages; and 'A Manual of Geometrical Crystallography', first edition, of 155 pages. The blowpipe section is a reprint of the practical little book that first appeared in 1910. We fail to see how any one with a slight knowledge of minerals and chemistry could fail to follow the instructions and obtain satisfactory results. The blowpipe is being used more and more in field work, naturally on account of the search for the rarer minerals.——In concise form, in the part devoted to mineralogy (under the headings lustre, color, streak, fracture, occurrence, and varieties), are to be found the native elements, sulphides, sulpho-salts, halogen salts, oxides, sesquioxides, intermediate oxides, dioxides, hydrous oxides, and sulphates, anhydrous carbonates, sulphates, and silicates, hydrous silicates, phosphates, arsenates, chromates, and hydrocarbons. The important features are in bold-face type. A list is given of commercially important ores and some useful tables. Although blowpipe work follows this mineralogy, a line under each mineral could easily have given the color by bead test.——Crystallography is useful for two purposes, (1) to be able to detect the difference between crystals, and (2) to be able to recognize crystal forms and systems. The author says that the 'sight recognition' of minerals is now a growing instruction, and his explanations are with this end in view. Those interested in crystallography will find this part well discussed. Altogether, these three books in one should be of considerable use to any one in the field, also in the laboratory.

Chemical Combinations Among Metals. By Michele Giua and Clara Giua-Lollini, and translated from the Italian by G. W. Robinson. Pp. 341, ill., index. P. Blakiston's Son & Co., Philadelphia, 1918. For sale by 'Mining and Scientific Press'. Price, $4.50.

To review this work adequately would require strenuous study and parallel reading. It is rather a symposium on the subject, and there is a paucity of views by the authors. There is not sufficient connection between the various conceptions. Many of the chemists' names given are not known in America, although that does not lessen the value of their ideas. The matter is thoroughly portrayed, and is made easier to understand by the numerous charts. A personal investigation is necessary to follow it all, but later somebody must integrate the theories given. It is a highly technical work, and is of use mainly to investigating chemists, although it will be found useful in chemical calculations. An idea of the matter covered may be gained from the chapter headings, namely: 'Equilibrium Diagrams', 'Thermal Analysis', 'Nature of Inter-Metallic Compounds', 'Physical Properties', 'Homopolar Inter-Metallic Compounds', 'Heteropolar Inter-Metallic Compounds', and 'Ternary Inter-Metallic Compounds'. Following are examples taken at random:

Silver-gold-tellurium: This system has recently been investigated by Pellini, who has directed his researches in particular to the system $Ag_2Te.AuTe_2.Te$, and succeeded in defining the compound $(AgAu)_2Te_2$, in which gold partly replaces silver. The experimental study of this system presented difficulty, for the thermal phenomena were not always well defined. The ternary compound does not separate directly, but melts with decomposition. The investigation of all the states of equilibrium in this system is by no means complete, and the complications that occur in the binary systems comprised in it vastly increase the difficulties of thermal investigation. The possibility of the formation of ternary compounds of silver, gold, and tellurium seems evident when it is considered that such compounds occur naturally. Gastaldi has recently described such a compound, to which he gives the formula $(AgAu)_2Te_3$. These ternary combinations of course belong to the group of heteropolar compounds. If they result from the union of dissimilar atoms, the part substitution of an electro-positive element by another closely-related element is always possible. No other ternary combinations have as yet been deduced from the study of equilibrium diagrams. From the physico-chemical point of view these compounds are only known to a very small degree owing to the lack of systematic researches, as is the case in so many binary combinations.

Lead-bismuth: It is doubtful whether chemical combination occurs between lead and bismuth. The system has been studied by Mazzotto, Kapp, Stoffel, and Barlow. The two branches of which the equilibrium curve consists intersect at 125° and 55% bismuth. According to Kapp, the thermal effects corresponding to eutectic crystallization occur from 36 to 98% of bismuth, which would show that up to 36% of bismuth solid solutions are formed.

Zinc-iron: Iron forms with zinc the compounds Zn_7Fe and Zn_3Fe. There are also three series of mixed crystals. The system has been studied by Wologdine, Guertler, von Vegesack, and finally by Raydt and Tammann. At 777° and 25% of iron the melt separates the compound Zn_3Fe which undergoes a transformation to the compound Zn_7Fe at 662° and 15% iron. As above mentioned there are three species of mixed crystals, one up to 0.7% of iron, the second from 7.3 to 11% of iron, and the third from 80 to 100% of iron. From 25 to 86%, the alloys consist of saturated mixed crystals and the compound Zn_3Fe; from 25 to 15% of the two compounds Zn_3Fe and Zn_7Fe; and from 7.3 to 0.7% of the two saturated mixed crystals. Magnetic properties are observed in alloys from 26.2 to 96% of iron; such properties diminish in intensity with decrease of iron content. The alloys with 11 to 22% of iron containing the two compounds are exceptional. Probably their properties are due to the presence of small quantities of iron. On heating, such alloys lose their magnetic properties. The iron-zinc alloys are porous, hard, and very brittle.

Gold-zinc: Gold and zinc form the following compounds: $AuZn$, Au_2Zn_3, and $AuZn_8$. The system was studied by Vogel. At 50% zinc and 744° there is a maximum corresponding to the compound AuZn which, by reaction with the melt, gives mixed crystals with gold and zinc. Between 50 and 63% of zinc, mixed crystals separate with a higher content of zinc than is demanded by the formula $AuZn_3$, and at about 650° a homogeneous substance crystallizes which is the compound of the formula Au_3Zn_8. At 486° saturated mixed crystals are changed into a third compound. The maximal transformation is at 88% of zinc corresponding to the formula $AuZn_8$. Here a new series of mixed crystals occurs. Alloys rich in gold have the same hardness as that metal, are less tenacious, and not at all brittle. At above 31% of zinc the alloys show considerable hardness and brittleness. After 61% they become gradually less hard and brittle.

Copper-zinc: Copper combines with zinc, forming the two compounds Cu_2Zn_3 and $CuZn$. The equilibrium diagram of these alloys has been investigated by Roberts-Austen, Shepherd, Tafel, Carpenter and Edwards, and lastly by Parravano. Cu_2Zn_3 separates at 833° and 60% zinc, and $CuZn$ at 1005° and about 50%. It was noted that the region of existence of this latter compound became more restricted with fall of temperature.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

THE MINER AND THE AMERICAN RED CROSS

No one is able to appreciate the suffering of others like those who have suffered themselves; likewise, no one appreciates the need of relief agencies like those who have once been in a position to need relief. That is why the miners of this country can so thoroughly understand and appreciate the work of the American Red Cross. At all times this organization has furnished prompt aid whenever there has been a mine accident. Whenever the call has come, doctors and nurses have been hurried to the scene of the accident. And so it was that when the call came for Red Cross contributions in the great war fund drive last year miners responded by offering one day's wage. No working men have a more vital part to play in this War than the miners. During the week of December 16 to 23, a national 'paper is to be taken'. This is the Red Cross Christmas roll-call when every man, woman, and child is to be given the opportunity to support by his membership and his service this national organization for military and civilian relief. Women of the mining centres will also have a big part to play in this work.

A COAL-MINER BEING TRAINED AS A MINE-LAMP REPAIRER

HELPING THE CRIPPLED SOLDIER

By Elisabeth Tredwell Stebbins

*To a greater or lesser degree in the past, the mining industry has had to face the problem of the disposition of men crippled through accident while on duty. Generally they have been retained to do odd jobs, but there has been no real interest in finding out what these handicapped men could do in competition with their non-handicapped fellow-workers. These odd jobs have often been nothing more nor less than charity not any too carefully disguised. Often the job has been so easy that no self-respecting man would care to fill it, with the result that the holder of the position became discouraged and lost his grip on things almost as soon as if he had received his envelope for living in absolute idleness.

This is not the fate we should anticipate for our men who are serving us so gloriously 'over there'. Some of them will return, to all intents and purposes, the same as they left. Many of them, and these are the ones for whom we must plan, will return with physical disabilities. These men will want a chance in the mining industry as well as in many others.

Before considering positions in which a cripple may be an efficient worker in mining, let us look at some of the things that have been accomplished by the disabled. In 1881, a famous Frenchman, Daniel Vierge, was recognized as one of the world's best draughtsmen. Suddenly a stroke of paralysis bereft him of the use of his right hand. Nevertheless a few years later he was doing with his left hand far better work than he had ever executed with his right. Another example: Ivan, an unskilled Russian laborer, enlisted in the British Army and was disabled in battle. During the first month of his re-education as carpenter at Whitby, Canada, he constructed the model of a house, five feet high. He had no previous experience in woodwork. And then there is Michael J. Dowling of Minnesota. Through an accident he lost both legs, his right arm, and the fingers of his left hand, but he drives his car, rides horseback, and enjoys life. He does not consider himself a cripple and no one else would consider him such. These examples of what handicapped men are doing could be multiplied. It is the purpose of this account to explain how the crippled man can fill certain positions, and doubtless the mining engineer will immediately think of others to which a disabled man can adapt himself.

There are two varieties of artificial limbs—the dress arm and leg, and the work arm and leg. The two former are modeled on human lines, and are usually worn for the sake of appearance. The work arm, however, is a wonderful appliance. It is made to fit not only the individual using it, but also the use to which it will be put. Usually it is of metal with a device at the end for receiving attachments calculated for various operations.

The occupations to be mentioned bring to mind a strong and hearty man, but closer examination shows that none of the positions exercise all parts of the body. To be a trap-door tender or an oiler requires but one arm, supplemented by a portion of the other forearm or a work-arm. The engineer in charge of a hoisting-engine would never be hampered by the loss of a leg if his arms are intact. The work of a bank-boss or a foreman depends largely on the man's mentality. One strong arm would meet the physical requirements of these positions. From our early school-days, we have been accustomed to think of the blacksmith as a "mighty man", but it was the "muscles of his brawny

*Furnished to the 'Mining and Scientific Press' by the Publicity Department of the Red Cross Institute for Crippled and Disabled Men, 311 Fourth avenue, New York.

arms" that were pointed out for admiration. For all we know he may have had a wooden leg.

As in other industries, the office force may be drawn from the handicapped. All lines of clerical work are being done by the one-armed and their wages show that they are making good. As a matter of fact there is a certain accountant who has lost two arms. He does his work with artificial equipments. Any one can see that in office work, legs are only used as a means of locomotion. A legless man can be just as efficient in any clerical position as a man with both legs. The cripple is no longer handicapped. On the contrary, he will be made more efficient provided the job toward which he has an inclination is found and he is trained to fill it. He does not want sympathy of the wrong sort, he wants encouragement.

According to the Vocational Rehabilitation Act recently enacted by Congress those disabled in the military and naval forces of the United States have been placed under the joint authority of the Surgeon General of the Army and the Federal Board for Vocational Education. The Surgeon General has jurisdiction from the time the person is injured until he is restored to good physical condition, when he receives his honorable discharge from the service. The Federal Board then offers him vocational re-education and training which will enable him to return to useful active employment, and the United States Employment Service will co-operate in finding him work.

AMBULANCE ARRIVING AT AN AMERICAN RED CROSS HOSPITAL IN FRANCE

COMMERCIAL PARAGRAPHS

The Chicago Pneumatic Tool Co. announces the appointment of A. M. Brown as district manager of sales at Philadelphia, to succeed G. A. Barden.

E. T. Lednum, formerly manager for the **E. I. du Pont de Nemours & Co.** at Joplin, Missouri, is now with the firm at the Ideal building, Denver, Colorado.

The Dixon Crucible Co., in its monthly 'Graphite' announces the death of A. R. Lloyd, for 20 years in the firm's Philadelphia district sales office. He was 52 years old.

In a leaflet the **O. F. Jordan Co.** of East Chicago, Indiana, shows the efficacy of its spreader in removing snow from railroad tracks. One machine is reported to have saved $4340 in one day, when compared with the work of 2500 men.

The October 'Duplex Doings', of the **Duplex Truck Co.** of Lansing, Michigan, shows what its machines can do. One went over the top of Mt. Helena, Montana, the rise being exceptionally steep; others are doing good work in hauling grain; while others bring in long sticks of timber over mountainous roads.

The Ruth Company of Denver, Colorado, has sent us a copy of its Bulletin No. 10, of 12 pages, describing the construction and operation of the Ruth patented flotation machine. The apparatus is built with a series of cells, all of which are on the same level. Each cell has a diffusing compartment and a spitzkasten. The compartment contains the 'spumer'—the air and pulp distributer—which causes the whole cell to function. The spumer is the heart of the machine. There are no valves.

The E. I. du Pont de Nemours & Co. states that on November 19 the War Trade Board removed the embargo that prohibited the exportation of the higher-strength dynamites and ammonia-base dynamites. This means that you are now permitted to export ammonia dynamites and dynamites containing a greater nitro-glycerine content than 40%; in other words, you will now be permitted to export higher-strength dynamites than Du Pont 50% gelatin, Du Pont 42% gelignite, and Du Pont 40% nitro-glycerine dynamite, as well as the ammonia dynamites. All licenses that expired on November 15 or on subsequent dates will hold good until used.

In Bulletin 5, the **Allen Cone Co.** of El Paso, Texas, describes its patented cone. This apparatus is a classifier, de-slimer, and dewaterer. The special feature is an automatic float control, by which the spigot opening is regulated to discharge the settled sand only as fast as it accumulates. The cone is of the regular settling-basin type, operating without hydraulic water and making its classification by the upward flow of the water in the basin. This action is entirely automatic, and no power is required. Four sizes are made, from 3½ ft. diameter at overflow lip and 5 ft. 2 in. high, to 8 ft. diameter and 9 ft. 11 in. high. To protect the cone from acid solutions, it is lined by concrete. Allen cones are used by the Old Dominion, Mine La Motte, Burro Mountain, Shannon, Picher, St. Joseph, Arizona Copper, and Presidio companies, dressing vanner feed, flotation feed, desliming, dewatering, in the re-grinding circuit, etc. An interesting operation of the Allen cones is the building of a tailing-dam 1150 ft. long at the Old Dominion at Globe, Arizona. The cones are on movable trucks. The cones remove the sand, which packs well.

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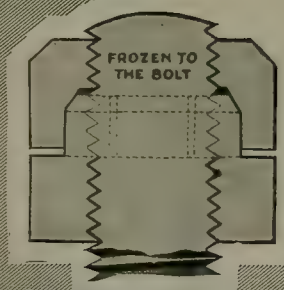

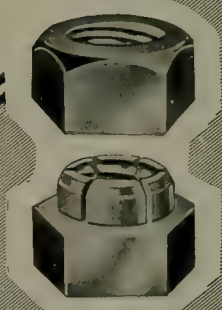

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EDITORIAL STAFF

T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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BUSINESS STAFF:

C. T. HUTCHINSON, *Manager*
E. H. LESLIE, *600 Fisher Bdg., Chicago*
A. S. BREAKEY, *3514 Woolworth Bdg., New York*

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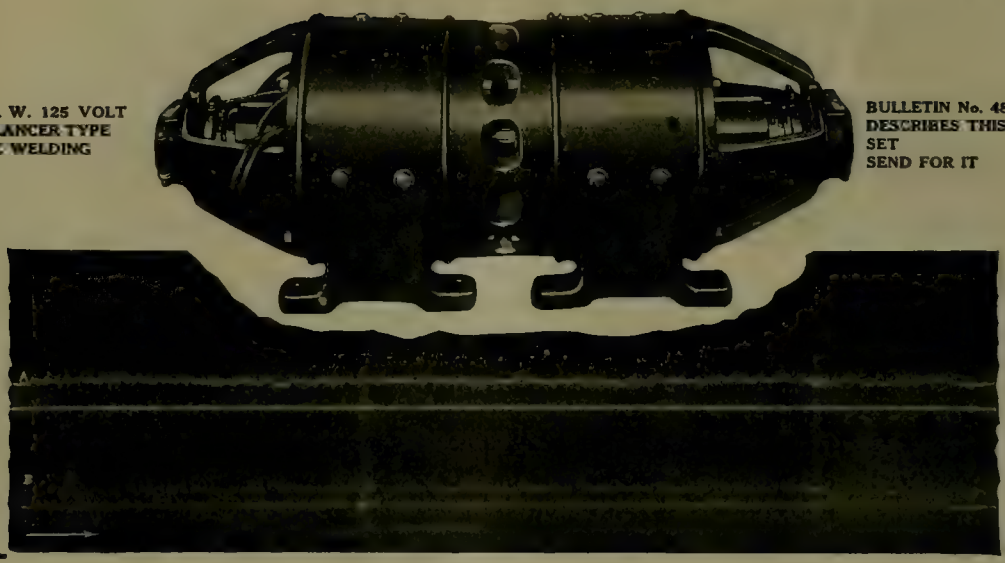

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TO make November 11 an international holiday, in order to celebrate the successful termination of the War, is a natural suggestion, but that would give us three holidays in one month, the other two being Election Day and Thanksgiving. It would be a good idea to fix Thanksgiving day on November 11 and so combine the thankfulness after harvest with that for our deliverance from the threat of Prussian bondage.

OFFICIAL statistics show that 14,661 officers and men in the British merchant marine and in the fishing industry were killed and 3295 were taken prisoner "while pursuing their ordinary vocation" by the Germans. This does not include the passengers—men, women, and children—murdered by the pirates during their submarine campaign, which failed in everything except in embalming the name of Germany in shame.

THE committee appointed by the Secretary of the Interior to make a study of American gold mining in relation to the increased cost of operations and the decreased output, and to suggest measures of relief, is said to be nearly ready to report. This committee consists of Messrs. Hennen Jennings (chairman), J. H. Mackenzie, Charles Janin, H. D. McCaskey, and F. L. Ransome. The first three represent the Bureau of Mines; the last two, the Geological Survey.

ANNOUNCEMENT is made by the U. S. Bureau of Mines that furloughs for mining men have been discontinued and that the general demobilization will suffice to release those urgently needed for industry. Steps will be taken immediately to return metal miners to their work. The Bureau desires to learn the names and addresses of any key-men for whom mining companies wish to secure prompt discharge. Such information should be sent to Mr. Edwin Higgins, Certifying Advisor, at 625 Market Street, San Francisco.

NEW YORK, Chicago, and Salt Lake City are reported to have passed an ordinance forbidding the display of the red flag. This represents a worthy expression of civic opinion. Those that "see red" should be invited to join their Bolshevist friends in Russia and Germany, or their nearer I. W. W. friends whom a judge at Chicago recently sentenced to a life of seclusion. There is no room for them in the open air of this country.

POTASH is the subject of a comprehensive article appearing in this issue. It is written by Mr. Frederick W. Brown of the Bureau of Soils and summarizes admirably the principal facts governing the consumption and supply of this chemical substance. We are amused by a paragraph appearing recently in the 'Wall Street Journal' suggesting that our domestic production of potash should not be developed "to the point where a high protective tariff would be required" because forsooth it might interfere with the utilization of the potash deposits of Alsace and thereby hinder France in recouping herself for her losses in the War. This looks like a sly bit of German propaganda.

UPON another page we publish extracts from the correspondence between the superintendent and the general manager for a mining company whose working force was afflicted by the influenza. It will remind many engineers of their own experience and will illustrate to what extent mining operations have been crippled by this black plague. Mr. Charles A. Chase, of the Liberty Bell mine, is well known to many of our readers. Mr. Douglas Muir was formerly on the staff of the Guanajuato Reduction & Mines Company in Mexico; his wife is the daughter of Mr. Bernard MacDonald. It appears that the influenza has been particularly hard on those living at high altitudes, as in Colorado. Mr. Sidney J. Jennings, while recently in San Francisco, stated that 34 out of 200 technical men on the staff of the United States Smelting, Refining & Mining Company had fallen victims to the epidemic. More soldiers in the Army at home were killed by it than died in action abroad.

WE note that the 'Mining Congress Journal' finds fault with a recent expression of opinion in these pages expressing keen dissatisfaction with the muddle made at Washington in the attempt to stimulate the production of chromite, manganese, and other war minerals. The spokesman for that eminently useful organization, the American Mining Congress, says that if there be men engaged in the Government's service "who represent primarily the interested industries" and if there

be cases where such service has provided "a camouflage of patriotism for the profiteers," if these things be, "the 'Mining Congress Journal' does not know of them." Then the gentleman is lacking in powers of observation; but this we do not believe to be the case, therefore we are compelled to conclude that he is prompted by diplomacy to asseverate his innocence of such knowledge. Evidently he shuts his eyes to many things in order to ensure a quiet life at Washington amid the mismanagement, inefficiency, and misdoings that have marked some, but not many, of the clumsy efforts to control mineral production during the War period. By the way, we thank him for reproducing our supposedly errant editorial, which must have appealed to many of his own readers.

RECENT disclosures all tend to confirm the conclusion that Germany was guilty of provoking the War. When the London 'Times', on July 28, 1917, gave an account of the meeting at Potsdam on July 5, 1914, at which the Kaiser and his party determined to force Russia and France into war, it was denied indignantly in Germany. Now the republican government of Bavaria publishes documentary evidence of the criminal purpose in order to prove complicity between Munich, Berlin, and Vienna. On this the 'Vorwaerts' of Berlin exclaims: "We were told that the German government did not know about the Austrian ultimatum beforehand. It is a lie. We were told that Berlin had expected Vienna to exercise moderation. It is a lie." It is indeed, as are so many of the other things said with great dignity and solemnity by the chancellors and foreign secretaries of the Central Powers. In due course the successors to William Hohenzollern & Co. will discover the diplomatic archives and uncover their contents to the world as the Bolshevists did at Petrograd, and when that happens we shall be treated to many proofs of German turpitude, and feel further satisfaction in finding that the inferences made from fragmentary evidence in 1914 have proved accurate.

PROTESTS have been made against any proposal to feed the Germans at the expense of the Allied peoples. We are informed that when the subject arose for discussion before the recent conference, in Washington, of the Food Commissioners from the various States, Mr. Ralph P. Merritt stated plainly that the people of California would refuse to stint themselves for the sake of those responsible for the War, and that Mr. Hoover hastened to disabuse those present of any idea that the Germans were to obtain food gratuitously so long as the peoples of the Allied countries were in need. When the Belgians, the Serbians, the French, the Poles, and the Russians have been cared for, then arrangements will be made permitting the Germans and Austrians to buy food at reasonable prices. The task is a big one and it will tax even Mr. Hoover's extraordinary executive ability, for 300 millions among the regions devastated by the Germans and Austrians are looking for help as against only 50 millions needing help in the enemy countries. The call for conservation is not based upon any idea of feeding either the people of Germany or of Austria.

LEGISLATION excluding undesirable immigrants has been enacted and is to be enforced by the Department of Labor. By this new law, signed by the President on October 16, all anarchists are to be kept out of the country, also those who are known to hold the anti-social and destructive opinions connoted by Bolshevism and the I. W. W. The new law provides that, irrespective of the time of entry of an alien into this country, he may be deported if he has acquired such beliefs since coming here. We welcome such legislation, for it is a flagrant absurdity to give domicile to those that purpose to subvert our domestic peace or to pull our political house to the ground. Now that the War has fused the diverse elements of our population into a united nation, it remains for us to deal summarily with the poisonous propaganda that may be brought hither from the disorderly elements in Europe. Here we note with approval the announcement that Germans and Austrians who served the cause of the Enemy in this country and were interned as dangerous aliens during the period of the War are to be deported as soon as the treaty of peace has been signed.

The Paper Embargo

On another page we print a circular just issued by the War Industries Board announcing the withdrawal of sundry regulations on the consumption of paper by periodicals such as ours. This circular recommends the retention of many of the regulations in force during the War because they have helped largely to diminish wasteful practices in the business of publishing. With this recommendation we are in entire accord, for it is a fact "that no other industry has held its wares so cheaply as that of the periodical publisher, or has practically given away so much of its product." We quote from the circular. This wastage has proceeded on "the theory that the amount of circulation, and not the quality, is the basis of advertising value." Such a theory was entirely fallacious and the prevalence of it suggests a misconception of their own interests by the advertisers, for example, those selling machinery and mining supplies. All readers are not buyers; subscribers in arrears are either too poor to pay or else careless, and in either case they are not potential customers for those using our pages as a means of publicity; the custom of counting free copies or sample copies as part of the effective publicity is a radical mistake; an indiscriminate exchange between periodicals only burdens the mail and bothers the editors, the recent regulation compelling each editorial department to subscribe for its exchanges has served to prevent waste and has put this courtesy on a proper basis; the sending of an unlimited number of free copies to advertisers is a trespass on good nature and another form of waste, because many of the copies serve no useful purpose. We hope that the exigencies of the War period will have taught

advertisers to discriminate between bulk circulation and effective publicity. No cut-and-dried method suffices to measure the publicity value of a periodical, not even the cash receipts on subscription account, because every subscriber is not a reader and every reader is not directly engaged in the industry to which the periodical ministers. One copy may be read by ten persons; ten copies may be set aside unread. Generally speaking, it is not until a periodical is read appreciatively and intensively that the reader looks over the advertising pages. The whole basis of the business of technical journalism, for it is a business allied to a profession, is the printing of matter that is interesting to a particular class or type of men engaged, directly or indirectly, in the industry to which the technology, discussed and described in the periodical, is devoted.

The Chrome Scandal

The outlook for specific relief to the chrome miners has been difficult to determine. The sudden declaration of an armistice produced a large degree of uncertainty in the minds of Government officials as to appropriate policies to be followed in readjusting industries. On every hand it was recognized that the period of war industry had ceased; that the object of continuing production of the materials formerly needed for actual warfare must be mainly to close the contracted obligations of the Government, and to some extent to preserve the military establishment in a state of preparedness for eventualities. An armistice is remote from peace; the political problems confronting the nations must be settled before we may fully rely upon a safe deliverance from the need of employing the Army for the final pacification of Europe. Nevertheless, the great demand for munitions is over, and everyone knew it was over as soon as Alsace-Lorraine had been occupied by Allied troops. This meant that the need of chrome ore would be reduced on the side of military requirements. The fact that the War Minerals Act must acquire a new significance the moment that the German envoys accepted the armistice was patent, yet the President exercised his authority under that Act on the very day when the armistice was signed. That was on November 11. As there was nothing mandatory in the statute, it is to attribute thoughtlessness to the President to assume that he should choose to exercise the powers granted to him, even to the extent of delegating his authority to the Secretary of the Interior, unless he had a clear purpose that the measure was still capable of being utilized for the good of the people. Indeed, one of the strongest characteristics of President Wilson is the deliberate purpose with which he performs his administrative duties. Although hostilities have ceased he has permitted a recent order for taking control of the trans-Atlantic cables to become operative, and the only warrant for doing so lies in the construction he may put upon the words "for the national security and defence," which were used in the statute under which the control of the cables is assumed. As a matter of fact the war is not over until a treaty of peace has been ratified and a presidential proclamation to that effect issued. There are some problems of national defence and security that are not automatically solved by the cessation of the clash of arms. The same phraseology is used in the War Minerals Act, and the President must have had this in mind when he signed his executive order. It would have been simpler to have done nothing than to complicate the situation by technically putting the Act into effect, unless there was a determination actually to utilize it. Naturally it was assumed that the War Minerals Act would be applied by the Bureau of Mines as soon as it was known that the administration of it had been lodged with the Department of the Interior. It is likely that it will be put into operation, but difficulties have arisen and these cause delay at least. It is evident that an interpretation of the statute, clear enough and reasonable enough to be defended on technical grounds, must be made before action can proceed. If this be done, the justification on moral grounds is so large that a man would place himself in the position of criticizing the Government for performing its duty if he were to attack the use of the statute for the relief of the producers of the so-called war minerals.

The hesitation to apply the statute has been so marked as to indicate that strong pressure has been exerted to alarm the Administration over the possibility of hostile criticism. This has led, in official circles, to a tendency to minimize the responsibility of the Government in encouraging the production of the war minerals. No one in either the Geological Survey or the Bureau of Mines denies responsibility for encouraging the output of these materials, nor do they deny that a moral obligation exists, but the question of an obligation sufficiently direct as to convert this encouragement into an engagement on the part of the Government to require owners of mines to lease the properties or produce the ore has been denied. Such a claim, however, can no longer be advanced since the presentation to the Secretary of the Interior of a copy of a letter from Mr. Hugh H. Sanford of the ferro-alloys division of the chemical and explosives section of the War Industries Board, addressed on May 4, 1918, to Messrs. Rowen and Barton of Grants Pass, Oregon. In this letter it was stated: "We understand that you have a group of claims on land containing chromite ore, which property you have optioned from Young and Darnell of Crescent City, Oregon. We understand that you are not operating this property yourself and have been unwilling to lease same on the basis of royalties offered. It is the desire and intention of the War Industries Board that all properties containing valuable deposits of chromite, that can be reasonably operated, shall be developed at an early date, and we are not willing that properties should be leased which are of value to the country, and should neither be operated by the lessor nor leased by him to another operator. We, of course, have no knowledge of all the facts regarding this property, but simply wish to express our point of view,

and wish further to ask you to advise us immediately in the first place what the true facts are in your opinion, and in the second place to let us know whether immediate arrangements can be made with parties for operating this property in a way that will make this Board satisfied that the ore will be produced as rapidly and efficiently as reasonable to expect. Your prompt attention will be appreciated." This letter effectually disposes of any argument that the Government was depending on a mere voluntary response to requests for production. The letter announces a definite policy of the War Industries Board that "all properties shall be developed," and it carries a threat of compulsion unless production be made. This is something more than a contract; under a contract there is a remedy in law; but in this case the Government assumes a responsibility for demanding production from any property that "reasonably" can be operated, which implies that it may be operated remuneratively. In the particular case to which this letter refers the property was leased, a few days later, to the California Chrome Company, which fact Mr. Sanford mentions in a telegram on June 12 as having learned "from a party yesterday."

The stumbling block in the statute, which has caused difficulty in coming to a decision, is the requirement that in applying it with regard to any of the minerals named a shortage of that mineral must be declared to exist. It is pointed out that a large stock of chromite is now on hand in this country. The production in the United States this year, stated in terms of 50% ore, will be slightly above 60,000 tons. The consumption is estimated as reaching, or perhaps exceeding, 95,000 tons. The estimated imports for the year are 87,504 tons. These figures are as nearly accurate as the Geological Survey now can ascertain. The domestic production from January 1 to September 30 was 48,590 tons, with imports for the same period of 74,708 tons. The total estimated available tonnage for the year therefore is 147,504 tons. Subtracting the consumption, it appears that there would be a balance accumulated as stocks on hand amounting to 52,504 tons. In the fact of this the claim is made that the stocks in storage in this country at the present time exceed 125,000. Whether that be true or not, it is evident that the consumers do not take the view, in their own councils, that there is an over-supply available, because persistent efforts have been made, since the President signed the executive order relating to the War Minerals Act, to break through the restrictions upon importation imposed by the War Trade Board, and to secure shipping and license for considerably in excess of 5000 tons of New Caledonian ore. If there is not a presumptive shortage in view of anticipated needs, it is hard to explain this eagerness to import more. Mr. Sanford attempted to explain it on the ground that the importers had bought it, and naturally wanted to have it delivered, but he did not explain why anyone should have bought 5000 tons of New Caledonian ore at a time when importation was absolutely prohibited and no reason existed for assuming that licenses to import could be secured. In the next place it is unlikely that any ore has been bought for which delivery based on prices paid has not been arranged through contracts for the finished product. It is also the expectation, as announced in the steel trade, and as further warranted by the effort of the Government to sustain the production of steel, that the consumption of chrome next year will be as large as during 1918, and the removal of restrictions may increase its use. On the other hand, in a free market there would be a tendency to demand higher-grade ore. The facts now available do not indicate that stocks are as excessive as they have been represented to be. In the event of complications arising before our return to a peace basis has been accomplished, there certainly would be no over-supply. The object of the bill was to provide "for the national security and defence," and the determination of shortage, in the meaning of the Act, is to be made in the light not only of a present but "a prospective inadequacy of supply," and this refers to a domestic supply of a material "formerly largely imported." This is standing on the technical construction of the measure, yet the fact is that this interpretation is no more straining the strict wording of the Act than it was to apply the Act under which the President has authorized Government control of the cables, put into effect after the armistice had been signed and its major terms largely fulfilled by Germany. If that be justifiable "for the national security and defence," how much more so is the application of a statute for further preparedness against possible difficulties, and at the same time discharging a high responsibility of the Government toward those whom it commanded to produce ores that would not have been touched except under these extraordinary circumstances.

Secretary Lane has stated that he is keenly aware of the responsibility of the Government, and is not disposed to shirk it, and it is probable that protection to the producers of chrome and of manganese will be given in some manner. A meeting of departmental and committee chiefs, consumers of chrome and manganese, and representatives of the producers of these substances, was held on Wednesday, November 27. On that occasion Mr. Lane suggested to the consumers that they purchase an amount of domestic ore proportioned to the tonnage imported. The consumers refused point-blank to do this; whereupon Mr. Lane intimated that some action might be expected under the War Minerals Act. The final word as to what shall be done will rest with the President, and, all other solutions failing, he may be called upon to determine the appropriateness of declaring a shortage in the meaning of the Act. The statute does not apply automatically to all the minerals mentioned in it. Each one must stand on its own merits and a declaration must be made that it is "necessary" as defined in the text of the Act. In the end, the great question involved is the honor of the Government, and this the Government will not disregard. The technicality of the law will admit of strict construction with so great a principle for its justification.

Chemical Analyses

The Editor:

Sir—Half, at least, of the published analyses of minerals and slags are worthless, because the chemist lacks the moral courage to report his results as he finds them. His ambition seems often to be to reach 100%, regardless of considerations of honor. This remark does not apply alone to the humble assayer, ill-equipped and inexperienced, but to men in high places, men of repute. Many analyses bear internal evidence of having been 'trimmed', to bring them to some recognized standard; others wind up with the too customary phrase, "water and loss," which in itself is an evidence of faulty work. To reach 100% is a poor ambition, but to ascertain accurately and state honestly the proportions of one, two, or a few constituents is worthy of the ablest chemist. Generally speaking, it would be better if the analyst would confine himself to those components which he has the facilities and the knowledge to discover and weigh rather than to proceed further to unknown depths in the investigation. No chemical analysis, no matter by whom made, is much more than an approximation. We should, therefore, not expect that the average manipulator will get close to the precise truth. Still, the shibboleth of '100%' has taken possession of him, and the chances are that some guesswork, some doctoring, will be done to his results.

I am moved to speak thus strongly because I have given myself to the study of furnace-slags, and have accumulated an immense number of published and contributed analyses. In doing so I have been much vexed with the unsatisfactory character of much of this material. Slags are oftentimes very complex in their composition, and contain substances not susceptible of exact estimation. Nevertheless, I find all the analyses footing up to the invariable 100%, eked out perhaps by 'water and loss'. As a matter of fact, the analysis of a slag is a difficult job, requiring time and considerable apparatus, as well as no small chemical knowledge; therefore it is no disgrace to a practitioner, especially a young one, not to reach perfection in such work. Even the qualitative examination of such a slag, embracing perhaps the discovery of twenty or more substances, is no small feat for beginners. They might, however, have the grace to report honestly what they find, and let it go at that. There are some glaring instances of carelessness, to call it by no worse a name, that have come to my notice through my examination of these analyses, which, if published, would reflect severely upon certain chemists of nation-wide celebrity. For example: A Government chemist, renowned for skill and accuracy, undertook the analysis of the so-called Ducktown slag, with all the resources of the Washington laboratories. His results, widely published, footed up to 100%, of course, but I notice that he left out the sulphur, as well as the oxygen that goes with the magnetic oxide of iron, which is always a constituent of such slags. Imagine his feelings if this were published with his name! It was not until within comparatively late years that chemists began to realize that sulphur and magnetic oxide were present in all such slags, and they were never computed in the earlier analyses. Nevertheless, the analyses footed up to the good old 100% just the same.

Conditions are quite as bad in mineral analyses. I have before me an analysis of feldspar that was copied out of Dana by an honorable gentleman, professedly a chemist, who got paid for making the analysis. Can you beat it? I do not imagine that the average chemist would sink to such depths, but I would like to impress it upon chemists in general if their published work is to amount to anything that, without reference to any standard, the constituents should be reported exactly as found. It is advantageous to know them all; but next to this we should know at least the principal ones as they are. It would be refreshing to meet with an analysis that overran 2 or 3, or even 5%; for then, we may be sure, there would be no question of 'water and loss'.

HERBERT LANG.

San Francisco, December 2.

The Chromite Scandal

The Editor:

Sir—Accept my thanks for the interest you have taken in the small chrome producers of the Coast. After reading the Government bulletin on chrome, and getting all data possible from other sources, I put all the money I had and then some into some chrome properties at Salmon Falls, in El Dorado county. These properties are now developed sufficiently to show up considerable ore, mostly low-grade, in fact, enough for a concentrator, but as things now look, I stand to lose my money, and most of a year's time. However, there is no use crying over spilled milk. I am now trying to locate a job at my old work of prospecting for dredging-ground.

F. L. BURNETT.

Folsom, California, November 13.

The Editor:

Sir—In coincidence with the country at large, and Mr. Blakemore's article in particular (in your issue of No-

vember 30), I wish to say that I am, or rather would be, a producer of manganese myself. On my own resources I got out, and still have, 17 tons of hand-picked ore at the loading-place; but, as soon as the unfair proceedings to the producers of chrome took place, I was not able to secure the capital that had been promised me to further the procedure. The importation of the ore from foreign countries is both unfair and unjust, and so surely as the American government had a right to demand the support and loyalty of her citizens in times of war, then just so surely have American citizens the right to demand protection from their government in times of peace.

DARIUS E. WELLS.

Rogue River, Oregon, November 29.

Platinum in Dunite

The Editor:

Sir—I trust you may find this communication acceptable. In the 'Mining Magazine' for September last there appears an article by E. Mackay Heriot touching on platinum in Spain. In your issue of November 9, you comment justly on it, and say it should be or is interesting to Californians. Now I wish to remind you and others of a similar discovery some years ago nearer home. On Oluime mountain, in British Columbia, Prof. Kemp of the U. S. Geological Survey discovered platinum in place in dunite, a variety of peridotite, as much as half an ounce per ton. For some years previous it had been collected with gold in the Tulameen river. Mr. Kemp trailed it to its source. In this belt the platinum is not confined to the peridotite. We found it in pyroscene and all the varieties of them, basic and acidic rocks, but nearly always mechanically combined with magnetic or chrome iron. I have pieces of it in my pocket now. I had assays from a trace to $108 per ton from picked pieces of chrome iron. We got gold nuggets of as much as four ounces, along with the river platinum, yet, strange as it looks, there has been no profitable gold ore found in that locality. The chrome iron carries diamonds so small that they are called 'dust', for they are of no commercial value but of as good quality as ever was found. There are some the size of an ordinary pinhead. Prof. Johnson, of the Canadian Geological Survey, will give full information on this subject. His address is Montreal. I must add that we got clean platinum as well as that connected with rock and iron from the river and half gold and half platinum mechanically combined, a few pieces.

J. C. REILLY.

Vancouver, B. C., November 25.

[We shall ask Prof. Kemp to enlighten us further on the subject. Our Victoria, B. C., correspondent has several times referred to the possibilities of platinum on the Tulameen river. Prospecting for the metal was stimulated by the Dominion Geological Survey. Holes were drilled to bedrock on bars and benches to determine the value of the ground. A Tacoma company erected a dam, flume, and centrifugal pumps and started to work the bed of the river.—EDITOR.]

The Embargo on Paper

The Director of the Pulp and Paper Division of the War Industries Board issued the following circular under date of November 27:

From today all rules and regulations of the Pulp and Paper Division affecting the publication of all periodicals excepting newspapers are withdrawn.

It is strongly recommended, however, that certain features of these regulations and recommendations be retained. During many years of sharply competitive business, various wasteful practices of circulation have developed, on the theory that the amount of circulation, and not the quality, is the basis for advertising value. Perhaps no other industry has held its wares so cheaply as that of the periodical publisher, or has practically given away so much of its product. Under the necessity of conserving all paper possible, the Pulp and Paper Division of the War Industries Board was compelled to eliminate these practices. These restrictions have not only conserved paper, but have proved profitable and beneficial to the publishers themselves, and after conference with representatives of the War Committee of the publishers in the periodical, business, agricultural, and religious fields, the following rules have been unanimously agreed upon as good business practice. Their adoption as trade customs is therefore strongly recommended by the War Industries Board.

RULES RECOMMENDED FOR ADOPTION AS TRADE CUSTOMS

1. Discontinue subscriptions after date of expiration, unless subscriptions are renewed and paid for.

2. Do not give free copies; except for actual services rendered; except to Camp Libraries and Huts of organizations recognized by the Government, such as the Y. M. C. A., Red Cross, etc.; except to the Library of Congress and other Libraries which will agree to bind for permanent keeping; except to Government Departmental Libraries which use said periodicals in their work; and except for similar reasons.

3. Discontinue all exchanges except where necessary for editorial purposes.

4. Do not give free copies to advertisers, or advertising agencies, except one copy each for checking purposes.

5. Do not exceed Post Office allowance of sample copies.

6. Do not take from subscribers less than published subscription price except in subscription clubs for same or for several publications. In either case, each publisher should receive at least seventy-five per cent (75%) of published price.

7. When premiums are given the premium should have a fixed price at which it will be sold separately; and the combined price received by the publisher should equal the announced price of the premium plus at least seventy-five per cent (75%) of the published price of the periodical.

8. Do not sell advertising with a guarantee of circulation requiring a rebate if circulation falls below guaranteed amount.

THE JANNEY FLOTATION MACHINES IN THE ARTHUR MILL

The Utah Copper Enterprise—VII

Flotation Practice

By T. A. RICKARD

TREATMENT OF VANNER CONCENTRATE. This goes first to two 44 by 20 ft. Dorr thickeners, which increase the density of the feed from 6 to 24. The thickened product passes to two emulsifiers and 13 Janney cells of the mechanical type. They are placed in series, stepping six inches. All that is visible of this machine is the hood, which contains the motor. The vent-holes for the field-cores make it look like a beehive, the emblem of Utah.

This machine for froth-flotation was designed by T. A. Janney at the Arthur mill, and is the result of systematic experimental work in which the inventor was assisted by his late father, Frank G. Janney, and his brother, Frank G. Janney, Jr. Two types of machine have been developed. One is the 'mechanical', this term being used to designate the kind of agitation it produces, in contradistinction to the other type, which is based upon the pneumatic, as well as the mechanical, principle.

The 'mechanical' Janney consists of a chamber (22 in. diam. by 26 in. high) in which revolves a shaft carrying two impellers, each having four blades set at an angle of 45° and revolving at 570 r.p.m. This stirrer is actuated by an electric motor, to which the shaft is directly connected. When ready for work the hood containing the motor is the only part of the machine that is visible. Four baffles are fixed around the periphery of the chamber, the lower impeller moving inside these baffles on a level about one inch from the bottom, while the upper impeller moves one inch above the baffles, the effect being to ensure a complete and violent agitation of the pulp. Besides stirring the pulp, the impellers induce a circulation from the chamber to the spitzkasten and return. The spitzkasten, a V-shaped base attached to each side of the principal mechanism, receives the pulp after it has undergone such stirring as will create the froth essential to the process. The froth rises to the surface of the pulp in the spitzkasten and is skimmed into a launder. The skimmer consists of a blade attached to an interrupted eccentric that while revolving drops

the blade into the froth so as to give first a vertical and then a horizontal motion, thereby avoiding the breaking of the froth. The amplitude of the sweep of this skimmer is regulated by the throw of the eccentric; the depth of the skimming is controlled by a bent rod to which the eccentric is attached and by which it is maintained in the desired position. An important feature of the invention is the circulation of the pulp. The feed enters through a gate at the bottom of the 'spitz' and is drawn, by displacement, into a pipe that takes it directly to the agitating-chamber; it is then thrown upward and outward near the top of the 'spitz'. Thus a constant circulation is maintained, the volume of pulp undergoing treatment being five or six times as much as the volume of feed or of discharge.

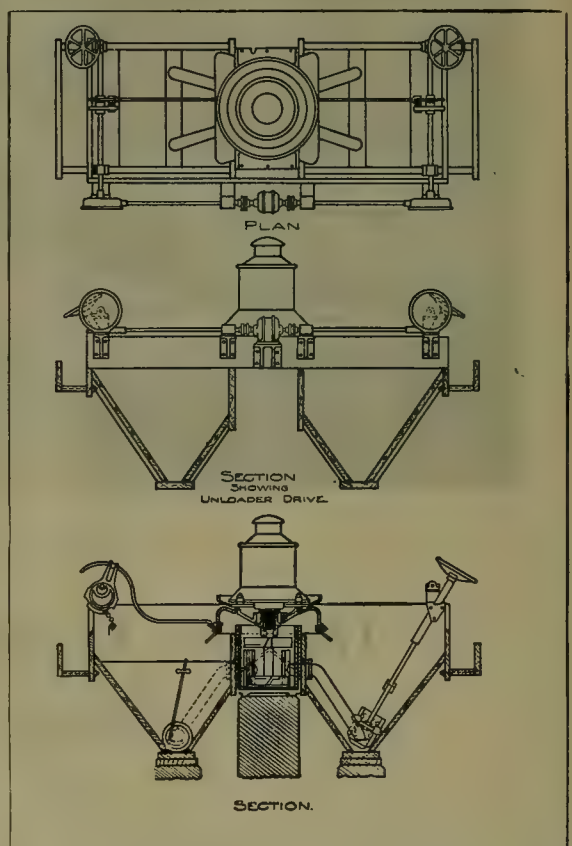
The 'mechanical-air' machine, as it is called, has the same kind of agitating-chamber, but the spitzkasten is provided with a porous bottom inclined at an angle of 35°. This porous bottom, or 'air-mat', is made of four plies of canvas through which air under a pressure of 3½ to 5 pounds is admitted. The air-pan is divided into three compartments, fed from corresponding pipes. The division is intended to compensate for the varying hydraulic head, thereby ensuring a uniform admission of air into the pulp.

The first machine in a series of either type of Janney equipment is used as a preliminary mixer, or 'emulsifier'. At this stage no metallurgical product is forthcoming. Here oil or other modifying agents are added just before the feed enters the mixer, and the pulp is prepared for the actual froth-making that follows in the second machine of the series, whatever the number of machines. The oil is added by means of a special device, designed to secure the constant feed necessary for the operations that are to follow.

From this mixer, or 'emulsifier', the pulp enters the 'mechanical-air' machine at the side of the agitating-chamber (above the lower impeller); thence it is ejected into the spitzkasten at a level higher than the inlet. In this chamber, which is open under the motor, there is an indrawing of air, as shown by a lighted match. In the 'spitz' the further aeration of the pulp is effected by the air that enters through the porous bottom, causing bubbles to be generated freely in the pulp, so as to buoy the particles of mineral to the surface.

The froth produced by the two types of machines differs notably, that of the 'mechanical' being denser and tougher than the froth in the 'mechanical-air', the product of which is more readily broken after it has been discharged, because, of course, once the froth has done its duty, it becomes a nuisance. The sooner it differentiates into liquid and solid the better. The reject of this operation descends over the air-mat to be returned by an interior pipe from each 'spitz' back to the agitating-chamber, the excess escaping over a weir into a launder or pipe that takes it to the next machine in the series. The froth from the 'roughing' machines is re-treated in the 'cleaners', to which it is pumped. The tailing from the 'cleaners' is pumped back and rejoins the feed to the 'roughers'. On the other hand, the reject from the 'mechanical' Janney goes direct to waste.

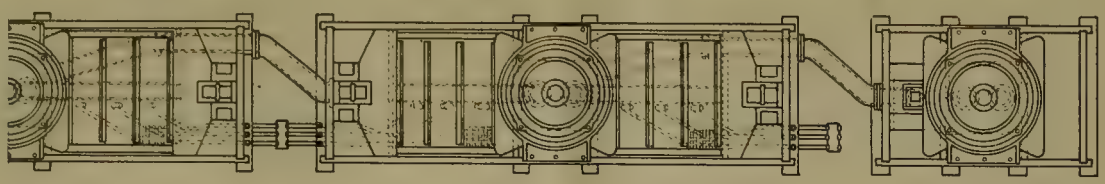
Turning to the drawing of the 'mechanical-air' machine, let us follow the flow of the pulp. It is fed at *A* and enters the opening *B*, part of it being thrown out at *C*, to rejoin *A*, producing a half-circulation at this stage. The other half is ejected at *D*, where the pulp drops into the box *E*, from which a portion is again drawn into the mixing-chamber through the pipe *F*, producing the other



JANNEY MECHANICAL FLOTATION MACHINE.

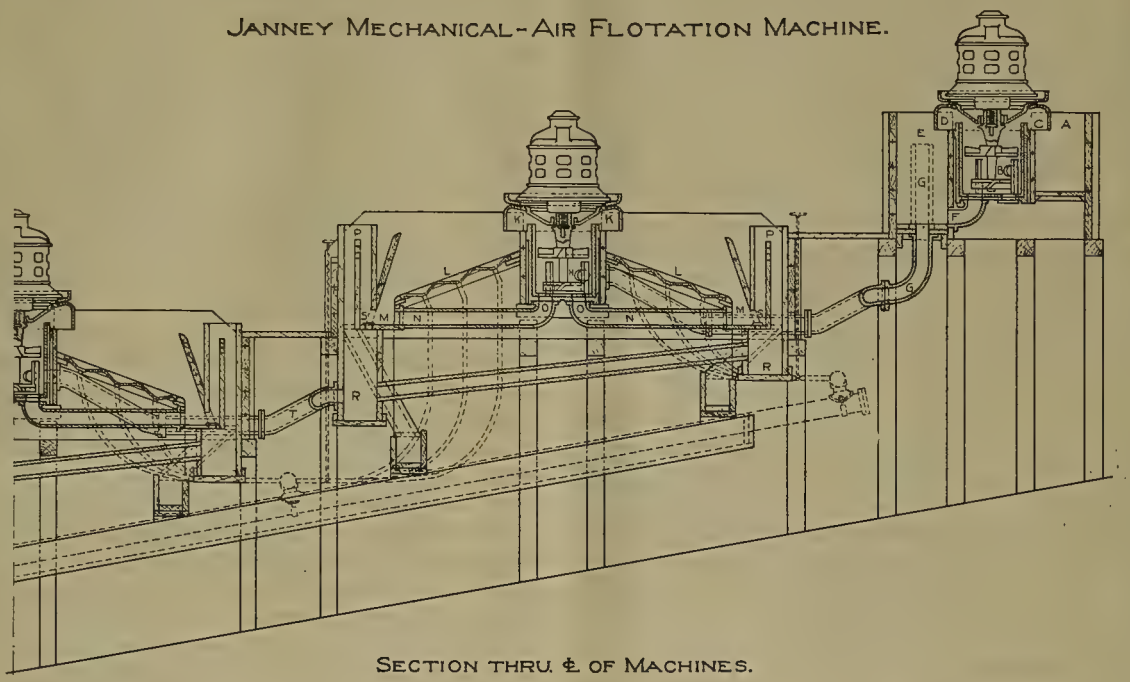
half of the circulation. The excess, equal to the feed, escapes through the pipe *G* into the next machine, which it enters at *H*, where it is ejected, at the points *KK*, into the spitzkasten, passing over the air-mats *LL* to the box at *M*, where part of the pulp passes back through the pipe *N*, joining the original feed of this machine at *OO*, while the excess escapes at *M*, the sand dropping through the spigot *S*, while the slime rises over the weir *P* and falls into the box, where it joins the sand, the joint products passing through *T* into the next machine.

Returning to the flotation of the vanner-concentrate; a sample of the froth when shaken in a pan and patted with the hand, so as to break the bubbles, shows the black copper sulphide that has settled underneath. The



PLAN.

JANNEY MECHANICAL-AIR FLOTATION MACHINE.



SECTION THRU ℄ OF MACHINES.

first six cells produce a concentrate containing 25% copper, 21% iron, and 20% insoluble. The number of cells in use to produce a finished product is regulated by the character of the feed, any cell being made to yield either a middling or a concentrate by shifting the baffle that divides the launder lengthwise into two compartments. The product of the last seven cells is a middling, which is returned for re-treatment.

The oil-mixture consists of mineral, pine, and creosote oils. The feeding of the oil is effected by a special machine of water-wheel type; it is a wheel having small buckets on its periphery dipping into a tank of oil that is kept at a constant level by a constant inflow, the excess returning to a storage-tank, to be returned by a centrifugal pump. The tank to which it returns is equipped with a steam-coil so as to maintain the oil at a uniform consistence. The speed of the feed-wheel is controlled by a friction-disc that regulates the speed as required, maintaining the feed of oil in excess of 10 lb. per ton of ore. A sulphonated alkali, called 'calura', is added to the pulp before it enters the two emulsifiers in order to act, like acid, as an electrolyte; and thereby increase the efficiency of the process, it having been found that the feed requires an alkali instead of an acid. The slimed feed requires an acid; the granular feed an alkali. The amount of vanner-concentrate sent to flotation is 466 tons daily; that of slime is 12,000 tons.

TREATMENT OF SLIME. The slime from the water-concentrating mill runs into ten Dorr thickeners, six of which are 75 by 12 ft. and four 75 by 18 ft. Four more, 75 by 18 ft., are being added. The density of the inflow is 8, and the density of the outflow 24.

From the thickeners the pulp passes to three small equalizing-tanks (8 by 12 ft.). Eventually six equalizers will serve 14 thickeners. The purpose is to correct any fluctuation of feed to the flotation machines, and also to mix the feed with the middling that is returned from the cleaner-cells of the flotation department. Acid is added to the equalizers at the rate of three pounds of 60° B. sulphuric acid per ton of ore.

From the equalizers the pulp is conducted through 12-in. wooden pipes into a 24-in. concrete pipe that ex-

tends the entire width, 583 ft., of the flotation plant. From this conduit the pulp is distributed by 4-in. pipe to each row of cells—each row consisting of one emulsifier and five cells. There are 11 such rows to each unit of the plant, which when complete will consist of 11 units, 8 of them roughers and 2 cleaners, and one a recleaner. Thus there are 726 machines, of which 605 are working-cells and 121 emulsifiers. The emulsifier serves to distribute the oil equally throughout the pulp before it enters the working-cell.

In the roughing-cell a low-grade concentrate is produced and a clean tailing, the concentrate itself being retreated in the 'cleaner', while the tailing goes to waste. The tailing from the cleaner is returned to equalizing-tanks, in which it is mixed with fresh feed. The oil, at the rate of more than 10 lb. per ton of ore, is added by means of a special feeder, which consists of a flat-faced pulley that dips into a small tank of oil and thereby collects a film, to be removed by a scraper impinging on the face of the pulley just above the point where it enters the oil. This feeder is adjustable by the width of the overlap of the scraper. See page opposite.

No skimming device is used in the air-cells. The froth rises sufficiently fast, owing to the large volume of air forced through the porous bottom, to push the mineral-laden froth over the edge of the cell.

The air-machine in use at the time of my visit consisted of five twin-cells, back to back. This entire plant was made of concrete and tile, the latter for piping. Each cell was 9 ft. 4 in. by 4 ft. 3 in. The porous medium was a four-ply canvas stretched crosswise doubly on half-inch centres. Experiments were being made with concrete mats, because the canvas wore out after being in use for eight weeks. Air was admitted at the rate of 150 cubic feet per minute under 4½ lb. pressure. No air-machines are now in use.

The low-grade concentrate from the roughers is returned to two equalizing-tanks, 20 ft. diam. by 30 ft. high, from which it flows into a 24-in. concrete pipe and is distributed to each cleaner-cell through a 4-in. pipe made of concrete and tile. No oil is added to the cleaner, only to the cleaner-tailing before it is returned to the roughing-cell. The mixing of the oil for the mechanical-air machines is done by the emulsifier, the oil being added through valves on a 6-in. header, or pipe, through which runs a steam-pipe, maintaining the oil at a uniform consistence, the oil running from this pipe through ½-in. globe-valves directly to the emulsifier. On account of the large quantity of oil used it is not necessary to employ a mechanical feeder, the volume of oil sufficing to induce a continuous flow that is readily controlled by the valve.

The composition of concentrate and of tailing is as follows:

	%
Concentrate:	
Copper	18
Iron	17
Insoluble	34
Tailing:	
Copper	0.25

From five units the products run into wooden launders; from three units the rougher product and tailing, as well as the cleaner-tailing, drop in a cascade directly into separate concrete launders, the tailing-launder being 6 ft. wide and the concentrate-launder 10 ft. 6 in. wide. These deliver their contents to the return-pumps and main tailing-launders are required. The effect is to produce a small metallurgical Niagara, the function of which is to break the bubbles and produce a product more readily pumped.

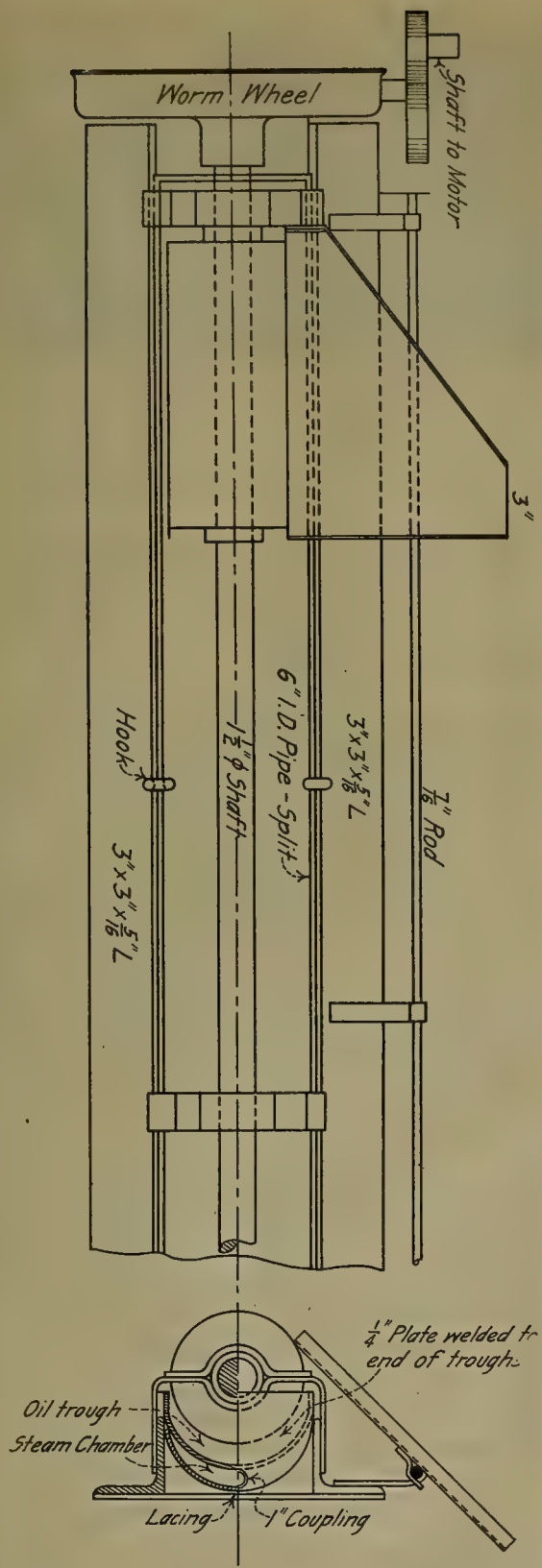
At the far end of the annex, looking down over a series of five double-cells, there is visible a big surface of froth—a veritable boiling sea—the five units occupying a space 100 by 265 feet.

Looking at a series of machines one can note differences in the froth due to causes recognized by the experienced millman. The best type of froth consists of light-gray bubbles, fairly large (two or three inches), of an evanescent character, that is, they burst as soon as they have done their duty of buoying the valuable mineral. A bad froth is lighter in color, the bubbles smaller, and not bursting sufficiently soon. Here I may mention that manipulation is an important factor in flotation. Much of it is empirical rather than scientific, it is not patentable nor is it well adapted to description, therefore the importance of it has not been emphasized either in litigation or in technical literature, but it has played and will continue to play a decisive part in successful flotation.

The two kinds of froth-concentrate are conducted by concrete launders to elevators that discharge into Dorr thickening-tanks, 75 ft. diam. by 20 ft. high, of which seven are in operation and one is being constructed. Here the density is increased from 9 to 51. These tanks are operated in pairs and in series, also intermittently, the idea being to operate a pair until the overflow from the second tank indicates that the suspended solid has accumulated to a level near the discharge, then the feed is diverted to another pair of tanks, until the same stage of repletion is reached. Experience shows that these tanks cannot be used as efficiently in parallel continuously as in series intermittently, because the range of the settling-rate is so great in the froth-concentrate that the colloids accumulate and remain in suspension within the tank.

Filtration. The concentrate produced by water, in the upper mill, flows in concrete launders to four drag-classifiers, which yield two products: (1) the slime, which carries the bulk of the water and flows to a bucket-elevator and is raised to a Dorr thickener (75 ft. diam. by 20 ft. high), the seventh tank of this kind; (2) the coarse portion, which contains about 10% moisture, is discharged upon a belt-conveyor (leading to elevators) that unites this product with the thickened flotation product coming from the other Dorr thickeners. Thus the water-concentrate is mixed with the froth-concentrate before undergoing filtration.

The filter-plant consists of eleven 14 by 14 ft. Portland filters. Another is to be added shortly. Of these 8 to 11



OIL-FEEDING DEVICE

are in constant use. They consist of revolving drums on which a porous medium of canvas is stretched; this is immersed in the concentrate during a part of its revolution, the pulp being drawn to the canvas by the vacuum induced within the drum. The pulp is sucked, and becoming dewatered, is detached by compressed air, which replaces the vacuum. Three Ingersoll-Rand vacuum-pumps of 9900 cu. ft. capacity per minute, serve to operate the filters, which make one revolution every 15 minutes. The vacuum capacity is equal to 1.5 cu. ft. of displacement per square foot of filtering area. The filter-cloth is No. 3 Oakdale canvas. Live steam is injected at the bottom of the hopper in order to heat the pulp and also to agitate it, keeping the coarse particles in suspension. These filters are not equipped with any mechanical device for producing agitation, because experience has shown that no agitation is required other than that caused by the introduction of the steam, as described. The hotter the pulp, the dryer the cake. As the vacuum withdraws the moisture the pulp forms a cake that is loosened by compressed air and removed from the surface of the revolving drum by a scraper that rides on the wires that wrap the filter. The scraper consists of steel plates, which warp and have to be replaced frequently. Experiments are being made with a scraper made in sections, so as to allow closer and more frequent adjustment, and thereby induce a clean removal of the cake.

From the filter the concentrate drops upon a belt-conveyor leading to a short inclined conveyor that discharges directly into a railroad-car. One man, with a hoe, is employed to supervise the loading. Five men are employed in the filter-plant per shift.

(To be Continued)

Costs at the McIntyre Porcupine Mine

Extracting gold ore from a depth of 1000 ft., and treating it in a modern cyanide mill, the McIntyre Porcupine company of Ontario in its last financial year reports costs totaling $5.1466 per ton, as follows:

	Per ton		Per ton
Exploration	$0.0572	Heat, light, water	$0.1437
Developing	0.8492	Head office	0.1725
Extraction	2.3499	General at mine office	0.2131
		Taxes, insurance	0.2199
Total mining	$3.2563	Bullion charges	0.0415
Crushing and ore transport	$0.1487	Total costs	$5.1466
Treatment	0.9039		
Repairs to buildings	0.0470		

Considering the abnormal condition, this total is not high, and is only an increase of 36.33 cents above the previous year. There was 82,089 oz. of fine gold extracted. This cost a total of $918,270, equal to $9.70 per ounce.

ASSAYING 41,409 samples at the Tabowie laboratory of the Oriental Consolidated in Korea, during its last financial year, cost 12.33 cents each.

CONCENTRATE TREATMENT by the Oriental Consolidated in Korea costs $2.16 per ton. The extraction is 83.2%.

An Influenza Story

EXCERPTS FROM LETTERS OF DOUGLAS MUIR, SUPERINTENDENT, TO CHARLES A. CHASE, GENERAL MANAGER.

Baldy, New Mexico,
October 30, 1918.

So far no influenza in this camp, though, as a matter of course, we hardly expect immunity. We have very cold weather and snow—which way this acts on the influenza, I do not know. In fact, there has been little or no sickness in Baldy since the doctor was removed, several months ago.

November 5.

After fooling us into believing that it would pass us by, the influenza—grippe—handed us a broadside between wind and water. The camp is 'hors de combat'. Dr. Bass came out from Cimarron on Sunday and treated 28 families and individuals at that time. He came again today and treated some 12 more cases. The mine lost several shifts cold. The mill has not suffered as yet, and if our one remaining mule-skinner is not afflicted, I believe the mill will suffer no lost time, as in spite of our somewhat reduced mine-crews for the past week we have some five days' ore stored in the chutes.

I guess trying to keep things moving under this trying circumstance got the best of me, for this morning I came down also. The doctor is imperative that I stay in bed until I am fully recovered. All this will explain why I have not been able to answer your several letters received the past week. It will be some little time yet before I can get around to this.

November 12.

The peak-load on influenza has passed Baldy at last. Had some 130 cases and 6 deaths to date. Some four are still in bad condition—Tony Ferganchick among them.

Have a doctor and one nurse in camp—also several untrained helpers. It will be next week at least till we can run, as all of us are so damnably weak and worthless now.

November 13.

I am sorry to tell you that Tony Ferganchick died last night at ten o'clock. His lungs filled up in a final rush after two or three doubtful days. His sister arrived here at 6 p.m. yesterday. This makes total of 8 deaths here to date. A couple of bad cases yet, but the rest of the camp is convalescent. It looks as if it is to be some time before we are the same as formerly. We cripples are mightly weak. Good weather has been much in our favor.

November 15.

This camp was one of the stricken places and it has played hob with mental attitude of nearly all here. I wrote you we had some 130 cases. To date, 11 deaths. Mrs. Damstra died this morning, leaving the three little children. Very sad. Jack Thorn and a couple of others are in danger yet. The whole camp was down. The few left have been digging graves, making coffins, and trying to take care of the sick. No lights in camp for a week because, once the light-engine quit, there were no engineers to start it. Have kept a little heat at hotel and houses with ordinary labor.

The men are leaving as soon as each gets well and able to travel. This condition will greatly affect our ability to get under way when we are able to go to work.

My children so far escaped. My wife came down the third day I was sick and I then had to get up and do the cooking and nursing for a while. Then went back to bed on her improval. We are both up and around the house, but mighty weak. It's one more bit of experience to be added to the store the mining man gradually accumulates. However, our experience has been no different from that of others in the camp and we are fortunate in that our cases were not among the dangerous ones. I trust that your family escapes this sickness or at least has light cases, since you mention that it may have already arrived.

The boarding-house people are discouraged and worn out with what they have been through and I am put to it to hunt up other parties for this work as soon as I can since they are going to leave us. Too bad, as they were a mighty good combination.

MANGANESE EXPORTS from Brazil during the first half of 1918 totaled 174,664 tons, compared with 245,088 tons in 1917, 240,090 tons in 1916, 102,870 tons in 1915, and 85,000 tons in 1914. The reason for the diminished exportation in the current year, as compared with 1917, is largely attributable to the difficulties of transportation over the Central Railway, which carries all of the manganese from the centres of production in the State of Minas Geraes to Rio de Janeiro, the principal port of exportation, according to a U. S. Consular Report from Rio. It is interesting to note the rise of the average price of manganese during the past four years. In 1914 it was 22 milreis per ton; in 1915, 29 milreis; in 1916, 55 milreis; in 1917, 93 milreis; and during the first six months of 1918, 117 milreis per ton (1 milreis = 55c. U. S., but the exchange rate is about 25c. to the milreis).

AIR-TANKS for regulating purposes on pipe-lines have not been considered successful. Their design is a matter of great uncertainty, but, if properly built, air-tanks are of great practical value in improving regulation and preventing water-hammer. Their design is simple and is based on fundamental laws, assording to M. M. Warren in a paper prepared for the American Society of Civil Engineers.

TIN AND TUNGSTEN production of Siam during the past two fiscal years was as under, in tons:

Year	Sn	WO_3
1917	9,466	800
1916	10,078	584

Royalty payable to the Government is 25% on tin and 10% on tungsten.

MINING MANGANESE AT LAS VEGAS, NEVADA

Stripping operations. The gravel on top of ore is tightly cemented. The Start of Underground Operations.

Manganese in the Colorado River Desert Region

The search for manganese ore during the last two years has disclosed some promising deposits in the arid regions in the south-western part of the United States. One area that may be considered a unit extends southward from the Great Bend in the Colorado river near Las Vegas, Nevada. It includes part of Clark county, Nevada; San Bernardino, Riverside, and Imperial counties, California, east of the 115th meridian; and Mohave, Maricopa, Yavapai, and Yuma counties, Arizona, west of a line running southward through Wickenburg. Examinations of the manganese deposits of this area have been made recently by E. L. Jones, Jr., of the U. S. Geological Survey.

Many of these deposits were discovered since the fall of 1917, and some have since become producers. The principal deposits, enumerated from north to south, are near Las Vegas, south-east of Topock; close to Artillery mountains, near Williams river; in Mohave and Yavapai counties; in the Aguila district, Maricopa county; in the Maria and Ironwood mountains, Riverside county; and in the Chocolate mountains, Imperial county. A few promising deposits are found along Colorado river between Needles, California, and Parker, Arizona. Many small deposits that have not yet been worked are widely scattered over the desert.

The northern part of the region is served by the Salt Lake Route; the central part by the main line of the Santa Fe; and a branch line of the same road from Phoenix, Arizona, to Cadiz, California, which crosses Colorado river at Parker; and the southern part by the Southern Pacific and the California Southern, which extends from Blythe Junction, on the Parker cut-off, to Blythe. Although it may seem that this region is reasonably well served by railroads, several large deposits are so difficult of access and so remote from the railroad that the ore from them cannot be marketed profitably. The producing deposits are from a few miles to 45 miles from the railroad. The ore is generally carried to the railroad by auto-trucks, but from one deposit on the Colorado river the ore was taken 43 miles by motor-boat to Parker and there transferred to rail. Desert roads that are continually traveled by motor-trucks must be repaired frequently to facilitate transportation. The ore from some of the deposits must be carried to the road on pack animals.

During the last year the deposits in this region yielded more than 20,000 tons of ore, containing 35 to 47% Mn, 2.5 to 20% silica, with little iron or phosphorus. Mr. Jones estimates that at least 100,000 tons of 40% ore could be produced from the known deposits in this region, but the geologic evidence appears to indicate that no single group contains more than 10,000 tons of high-grade ore, though here and there several deposits that lie within a small area may yield 15,000 tons. Most of the deposits contain from a few hundred to 1000 tons of ore.

The greater part of the ore is shipped to smelters east of the Mississippi, and is used in making ferro-manganese. At the present rate of production it is estimated that 8000 to 10,000 tons of ore containing more than 36% Mn will be produced during the last six months of 1918.

The manganese deposits of this region are of two main types: (1) veins and breccias, and (2) bedded-replacement deposits. Possibly a third type, of sedimentary origin, may occur, but it has not been definitely recognized.

Deposits of the vein and breccia type are by far the most abundant, and they are widely distributed over the whole area explored. The veins are found in rocks ranging in age from the oldest schists and gneisses, which are pre-Cambrian, to the youngest basalts and conglomerates, probably Quaternary. In the Bighorn mountains south of Aguila, Arizona, the manganese-bearing fissures cut both the old schist and granitic rocks and the Tertiary lavas that overlie them. The association of man-

ganese deposits with Tertiary and Quaternary lava flows is striking, and all areas where such rocks occur are promising fields for the manganese prospector. The manganese deposits contained in fissures and brecciated zones were probably formed during the same geologic period—probably the Quaternary. Practically no other metals have been found in the manganese deposits of this type, and they are therefore entirely different from the manganiferous-silver veins found in the Tombstone and Bisbee districts of Arizona.

Deposits of this type were noted in the Las Vegas district; in the Topock, Williams, Aguila, Bouse, and granitic rock and conglomerate fill simple fractures that have well-defined walls.

The manganese oxides of the brecciated zones and fissures are psilomelane, manganite, and pyrolusite. Psilomelane, the hard steel-gray manganese oxide, is found in the outcrops of most of these deposits and appears to have been formed through the alteration of the other oxides. In the Ironwood and Chocolate mountains, psilomelane has been found from the surface to the deepest workings, 70 ft. below, but in most of the deposits in lava-flows it is succeeded below, at shallow depths, by manganite and pyrolusite. Manganite com-

PART OF ARIZONA, CALIFORNIA, AND NEVADA, SHOWING SITUATION OF MANGANESE DEPOSITS

Parker districts; and in the Maria, Ironwood, and Chocolate mountains. Some of these districts, however, may contain also bedded-replacement deposits. The veins and brecciated zones range in width from a few inches to 12 ft., and in length from a few feet to a thousand feet. The ore-shoots within the veins and brecciated zones are from a few feet to 400 ft. long, and extend from 5 to 75 ft. beneath the surface; but their maximum depth in some of the principal deposits has not been determined. The depth to which manganese oxides extend in these deposits appears to be dependent in part on the size and nature of the fissures and the kind of country rock. As the oxides were formed by meteoric waters that circulated in the fractures it seems that narrow fissures or fissures in shear-zones might not be so favorable for deep-seated oxidation as large simple fissures having well-defined walls. The deposits in rhyolite, andesite, and basalt are generally found in brecciated zones which have no well-defined walls, but some veins that cut

monly occurs in stubby crystals in vugs or cavities in the ore, but it also occurs in long fibrous crystals and aggregates, as in the Flynn property north of Bouse. Pyrolusite, the soft black manganese oxide, is generally regarded as an alteration product of manganite.

The manganese oxides in most of these deposits are not associated with iron oxides, but the nodules of psilomelane found in basalt or lavas that are rich in iron-bearing minerals are commonly encased in iron oxide. The most abundant mineral that persistently accompanies the manganese oxides is calcite, but barite occurs in a few deposits. Quartz is apparently absent, although fragments of silicious rock are generally enclosed in the ore. In a number of deposits, at depths ranging from 5 to 50 ft., the manganese oxides are succeeded by a coarsely-crystalline, dark-colored calcite. The dark color is due to minute tree-like forms of manganese oxides. On decomposition this carbonate first yields the soft manganese oxides, which, on further weathering and

MINING MANGANESE AT LAS VEGAS, NEVADA

Opening new face of manganese. Men are cobbing ore with axes. The weight of the ore may be judged by the size of the lump the man near the barrow is about to throw.

7½-ton White truck and trailer hauling empty water-barrels on top of ore on trip to railroad.

chemical action, forms the hard psilomelane found in concentric crusts, some of which, however, contain shells of manganite.

The ore rarely consists of pure oxides of manganese, but is generally a breccia composed of fragments of country rock cemented together and partly replaced by manganese oxides. In order to make a shipping product most of the gangue is removed by hand-sorting or screening, which, however, does not effect a good separation and is wasteful of ore. In the Tolbard and Tres Amigos mines, in the Chocolate mountains, and on the Black Jack, Parsons, Groce, and Bray properties, in the Ironwood mountains, there are ore-shoots several feet wide that require little sorting. The ore shipped from these properties contains 38 to 47% Mn, 2% iron, generally less than 6% silica, and small quantities of phosphorus. Most of the ore shipped from the Aguila district contained 35% Mn, 2% iron, and between 15 and 20% silica. A few carloads contained over 40% Mn. The Hall property, near Parker, is a small producer of ore that contains about 45% Mn. The ore shipped from the Howard property, near the old Pittsburgh Landing, 40 miles north of Parker, on the Colorado river, probably did not contain much over 30% of Mn, because it was not sorted.

Manganese occurs in replacement deposits in the Las Vegas district, south-east of Topock, and in the Williams River district. The largest and best known deposit of this type is that worked by the Manganese Association at Las Vegas. This deposit is contained in beds of clay or tuff, and is cut or bounded by several northward-trending faults. The hills on both sides of the deposit are composed of rhyolite, tuff, and volcanic breccia. The ore-bed lies flat or nearly flat, and ranges in thickness from a few feet to 25 ft. It is underlain by a greenish sand or tuff containing angular fragments of rhyolite. Angular volcanic debris, from a few feet to 15 ft. thick, directly overlies the ore-bed. The ore is a soft brownish-black material, very porous, and of light weight. A 1-ft. cube of ore that weighed 81 lb. when first taken from the pit lost 8 pounds by drying in the air. An analysis of this ore by Smith, Emery & Co., of Los Angeles, gave the following results:

Manganese dioxide (MnO_2)	56.04
Manganese oxide (MnO)	7.08
Silica (SiO_2)	13.73
Alumina (Al_2O_3)	1.85
Iron oxide (Fe_2O_3)	1.68
Lead oxide (PbO)	2.07
Barium oxide (BaO)	0.02
Lime (CaO)	Trace
Magnesia (MgO)	1.41
Copper oxide (CuO)	0.49
Zinc oxide (ZnO)	None
Phosphoric anhydride (P_2O_5)	0.07
Sulphuric anhydride (SO_3)	0.43
Arsenic oxide (As_2O_3)	0.06
Soda (NaO_2) and potash (K_2O)	3.82
Moisture (combined water and carbon dioxide) by difference	11.25
	100.00
Total manganese (Mn)	40.91
Total available oxygen (O)	10.31

Most of the ore in this deposit is homogeneous and will not yield a product of higher grade by sorting or selective mining. The deposit contains, however, in the bedding planes, lenses of white or pink sandy material in places a foot thick, and veins or seams of fibrous gypsum, some of them 2 in. wide, that cut it at steep angles. These materials are readily separable from the ore. On the hillside a short distance east of the main deposit and 60 to 100 ft. above it, there are several openings that expose ore along northward-trending faults. Here the manganese oxides replace tuff and volcanic breccia in varying degrees. In places a breccia composed of fragments of ore and tuff is cut by calcite veinlets. Calcite is abundant in the tuff and volcanic breccia. The ore is in places overlain by a porous mass of gypsum and manganese oxides, which in turn is overlain by angular debris. The manganese oxides were probably introduced along the fault-fissures and replaced the more permeable tuff and the associated sandy clay beds. The manganese oxides are principally pyrolusite.

Other deposits lie along the base of the foothills in the Las Vegas field, extending two miles west and one mile east of the mine of the Manganese Association. None of these has been productive. Most of these deposits are associated with faults or fissures, and are contained in beds of tuff or clay. About two miles west of the mine of

the Manganese Association a drill was driven 77 ft. through beds of gypsum, clay, and tuff in the hope that workable beds of manganese would be encountered, but nothing of value was found.

South-east of Topock, besides the deposits in brecciated zones, there are several deposits of the replacement type, the largest or best developed being one of the Verdun group. The country-rocks are rhyolite, volcanic breccias, and tuff. In the Verdun group, a bed of tuff 5 ft. thick, which is exposed for several hundred feet along its strike, is replaced by manganese oxides. The bed probably contains an average of 22% Mn, 8% iron, and 15% silica. The oxides are principally wad and some pyrolusite.

A number of deposits in the Williams River district, south of the Artillery mountains, are replacements of sandstone beds. Some of these deposits contain large quantities of ore, and attempts are being made to ship from the higher-grade deposits. On the Santa Maria river, eight miles east of its junction with the Big Sandy, manganese oxides occur in beds of clay and sand in the bench-land that borders the valley.

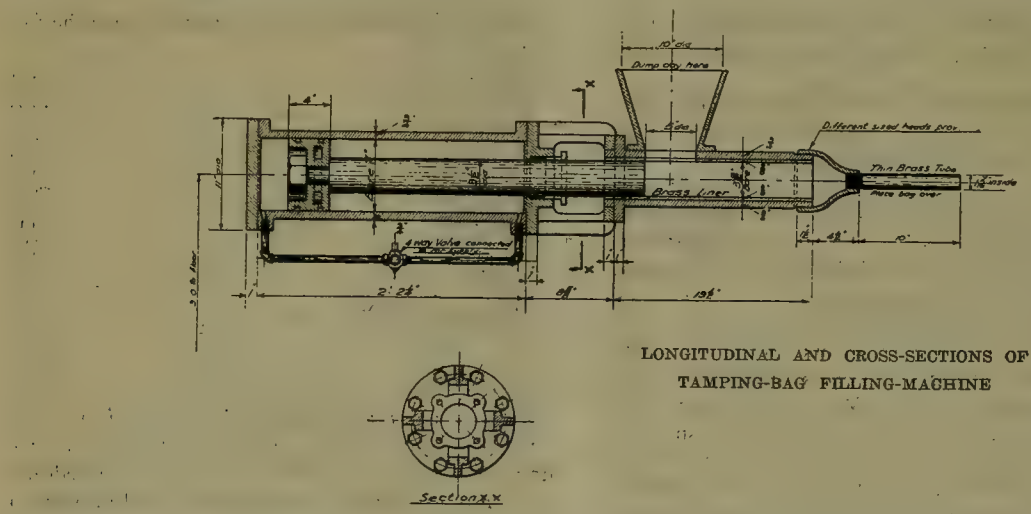
The manganese deposits of western Arizona, southern Nevada, and south-eastern California are mined by open-cuts, shallow shafts, and tunnels. All drilling is done by hand. Water is hauled from the railroad to most of the camps, but several operators have obtained a small supply from wells near the deposits. Labor is scarce, and most of the work is done by Mexicans. Wages are from $3.50 to $4.50 per day. Production has been greatly curtailed during the summer by the intense heat, but it will probably be increased in the fall. The cost of hauling the ore to rail varies considerably; it depends on the quantity of ore, condition of the roads, and length of the haul; but in general is 50c. per ton-mile. The cost of mining is said to range from $6 to $20 per long ton. The freight-rate to Chicago is $11 per long ton, and the rate to most furnaces in Pennsylvania is $15.

Unless the conditions are specially favorable, only high-grade ore can be shipped at a profit, even when prices are abnormally high, as they are now.

Tamping-Bag Filling-Machine

*The accompanying sketch shows a longitudinal section and a cross-section of a machine manufactured by the Granby Consolidated company for filling tamping-bags to be used as stemming in drill-holes before blasting. During the past three years many schemes have been tried to reduce the consumption of explosives. Tamping showed a saving from 10 to 15% in explosives.

The daily consumption of tamping at the Hidden Creek mine at Anyox, B. C., amounts to 400 bags, measuring 1½ by 10 in. each. The filling-machine consists essentially of a cylinder and a piston, which is actuated by compressed air. Clay is fed into a small hopper placed over an opening at the point end of the piston in its the air is let into the back end of the cylinder. This forces the piston ahead and pushes the clay forward through a narrowed aperture to which is fitted a thin brass tube slightly smaller in diameter than the desired cartridge, and about the same length as the paper bags used to make up the cartridges. The paper bags are fitted over the brass tube and the moist clay, which is forced through, fills the bag and at the same time pushes it off the tube. This machine can fill 200 tamping-bags per hour with ease. The material used is a fine blue clay common at Anyox under the glacial drift. Separate front ends can be used with any diameter tubes desired for making up different-size cartridges.



LONGITUDINAL AND CROSS-SECTIONS OF TAMPING-BAG FILLING-MACHINE

THE department of electricity of the French army employs oxy-acetylene welding mostly in connection with cracked frames of gasoline motors used in driving dynamos at and near the front. On account of shell fire it is found impracticable to bring electric current from generating-stations situated well to the rear, and therefore gasoline-motor generating-sets are employed locally. Two men and one set of apparatus take care of all the work necessary for an entire army of 200,000 or more men.

*Abstract from 'Granby News'.

Our Natural Resources of Potash

By FREDERICK W. BROWN

Introduction. Germany's monopoly of the potash trade in time of peace and the abrupt cessation of all shipments with the beginning of hostilities in Europe emphasizes the urgency of immediate development of American sources of one of the most valuable of chemical fertilizers. Within the last 70 years there has been a rapid development in the use of chemicals—nitrogen, phosphorus, and potassium—for inducing increased crop-yields. Before the war there were a hundred companies mining potash in Germany. More than 90% of their enormous product was used for agricultural purposes. German producers of potash are combined in a syndicate under supervision of the Government; the Government fixes the minimum price for which it may be sold and limits the quantity that may be exported. In recent years the United States has taken one-fifth of the entire output of the German mines and one-half of all allowed to be exported. In 1913 this country bought about 1,000,000 tons, nearly all of which was used for fertilizer purposes. In common with the rest of the world, the United States has been dependent upon Germany; to what extent is shown by the fact that in December 1913 muriate of potash sold here for $39 per ton and was quoted at $500 in December 1915, with only small lots available.

Before the development of the German mines in the early 'seventies of the last century potash was derived largely from seaweed and by leaching wood-ashes, and the supply, necessarily limited, was principally consumed in the arts. With the development of the German supply, however, the use of potash as a fertilizer ingredient has increased steadily.

There is no question of the general value of commercial fertilizers in farm practice. The farmer who wisely and systematically applies commercial fertilizer to his fields will raise larger and better crops than his neighbor who, with similar conditions of soil, climate, and rotation, and equal industry applied to cultivation, does not use fertilizers. This statement applies with the same force to the rich soils of the Mississippi Valley as to the soils of the Eastern cotton States or of New England. Moreover, an analysis of the fertilizer investigations carried on by experiment stations in this country and abroad brings out the significant fact that, generally speaking, the use of a complete fertilizer—that is, one containing all three elements—gives larger returns than the use of one containing either one or two of the fertilizer ingredients.

An ample supply of potash has therefore in the last half-century become an agricultural necessity. This is particularly true of certain large sections of this country where the soils are of such a character that profitable crops can be raised only when liberal applications of fertilizing ingredients are added, or where special crops are grown under a system of intensive agriculture. Throughout the cotton States, the tobacco-growing regions, the trucking sections of the Atlantic States, and in citrus-fruit and potato-growing regions the heavy application of commercial fertilizers, including potash, is now a recognized agricultural practice. With these conditions existing, it becomes evident that an adequate and reliable supply of potash has become necessary if American agriculture is to advance to meet the growing needs of increasing population. Up to the stoppage of all shipments the German supply of potash has been adequate, but these mines are not inexhaustible, and a time will come when Germany will see the need of conserving her diminishing supply of this agricultural necessity for the use of her own farmers. When this time comes, either another source must have been found or American agriculture must suffer.

In recent years a number of possible sources of American potash have been brought to public attention. For convenience of treatment here they may be grouped into three classes: trade-wastes, natural deposits, and kelp. There are a number of industries in this country handling materials from which potash may be recovered as a by-product. Until recently little effort has been made to effect such recovery, and large amounts of potash have been allowed to escape into the air or to run off with waste-waters.

Cement Manufacture. One of the more important sources of potash from such trade-wastes occurs in connection with the cement industry. Throughout the country exist deposits of feldspar and other silicates containing potash. This potash, however, is in an insoluble form, and the containing rock must undergo treatment before the potash is liberated in a form to be taken up by the soil-water and used by plants.

It seems unlikely that any process will be developed which will make it commercially profitable to treat the rock for the potash alone and discard the residue. The Bureau of Soils pointed out, however, some years ago, that the potash-containing silicates might be used in the cement industry and the potash saved as a by-product. It has been demonstrated in recent years that this procedure is entirely practicable through the installation of electrical precipitators in the flues of cement mills. One company has had this installation in operation for several years, and several other large mills are installing apparatus for the same purpose. In this process the combined insoluble potash contained in the clay used in cement manufacture is released and rendered soluble under the

*This article is by the Assistant in Charge of Investigation of Fertilizer Resources, Bureau of Soils.

high temperature of the kiln and passes off with the dust in the stack, where it is caught and thrown down by electric precipitators. A large proportion of the potash contained in the raw mix is recovered in this way; and while the initial installation of the precipitators is somewhat expensive, the cost of operation is small. If, therefore, the raw mix going into the kilns contains a sufficient percentage of potash, the process, even under normal conditions of the market, will pay an excellent return on the investment.

It may be of interest to state that the process was perfected with the object of abating the nuisance caused by the escape of fume and dust from a cement mill and the consequent injury to citrus groves at Riverside, California. Mills so situated that the fume and dust from their stacks constitute a nuisance to surrounding property may find it advisable to install the apparatus, even though the returns from the potash collected would not of themselves justify the expenditure.

Since 85,914,907 bbl. of cement were produced in this country in 1915, this appears at present a promising source of a domestic supply.

Blast-Furnaces. Similarly there is the possibility of a large supply of potash as a by-product of blast-furnace operations. Blast-furnace gas contains varying percentages of potash. In ordinary practice this gas is cleaned by passing it through dust-catchers and washers and is then available for use in the stoves for heating the air used in the blast and under steam-boilers. Recent practice has found a further use for the gas in operating gas-engines, but for this purpose it must be further cleaned by passing it through secondary washers.

At present a small proportion of the potash that escapes from blast-furnaces is collected in the stoves and boilers, but the greater part is lost in the wash-waters or escapes from the flues. Moreover, the presence of potash fume remaining in the gas as it comes from the primary washers is probably responsible for the condition so troublesome to furnace operators known as 'smoky gas.' An experiment recently conducted by one of the largest steel-mills of the country has shown that this necessary operation of cleaning the gas can be accomplished more satisfactorily and probably more economically by means of electrical precipitation than by the methods now used. In addition to furnishing a more effective cleaning of the gas, such an installation would recover practically all the potash. This appears to be an important potential source of potash, as the aggregate amount now volatilized and lost in the blast-furnaces of the country is very large.

Wool-Wastes. Among the impurities contained in wool as it comes from the sheep, and requiring to be removed before the wool can be used by the spinner, is a material called 'suint'. This really is the dried sweat of the sheep. It is soluble in water, and consists principally of potash salts. In addition to suint, crude wool also contains grease, and any process for recovering potash from wool must include the recovery of the grease also to be commercially profitable. Wool-grease is used for dressing leather and for lubricating purposes, and is also the source of the valuable lanolin compounds used in pharmaceutical preparations. Probably the best method of wool scouring is called the 'solvent' process, and recovers the grease and suint separately. The wool is treated with a volatile solvent (gasoline, naphtha, or carbon disulphide) which removes the grease, and is then washed in warm water to extract the suint. The solution of wool-grease then is distilled, in which operation the solvent passes off and is recovered for further use, and the grease is left as a residue. The solution of suint is evaporated and calcined for its potash.

In 1914 about 290,000,000 lb. of raw wool was produced in this country, and about 220,000,000 lb. was imported. The potash content will average about 4½% of the weight of the crude wool, so that approximately 11,500 tons of potash might have been recovered from the wool scoured in the United States in that year.

Wood-Wastes. The wood-using industries of the country produce a large amount of saw-dust annually, and much of this is used as fuel in the furnaces of the plants. It is probable that much of the wood-ash so produced is now used for fertilizer purposes and to this extent serves as a source of potash. So much as is not so used should be, or should be leached for the recovery of potash salts. Wood-ashes vary widely in their potash content, this variation being dependent on the species and on the part of the tree from which the wood is taken. It is impracticable, therefore, to estimate the amount of potash that might be derived from this source, but it would come to several thousand tons.

Many farmers use wood for fuel, and anyone so situated has at hand a source of potash that should be carefully saved. While the amount so secured by an individual necessarily will be small, in the aggregate a considerable saving would result. If home mixing of fertilizers is practised, wood-ash should not be mixed with other ingredients, but should be applied to the soil separately, as the lime in the ash has a tendency to liberate the nitrogen in certain other fertilizer constituents if mixed with them.

Natural Deposits. So far the extensive investigations of the Bureau of Soils and the Geological Survey have not disclosed any deposits of potash salts in this country comparable in extent or commercial importance with the German deposits. Such sources of potash salts as have come to light are confined to the desert basins of the West and are small in extent. While some of these may become of local importance, the total potash that can reasonably be expected from them is too small to be of importance beyond a limited area contiguous to the mines. It is, however, always possible that borings put down for water, oil, gas, or for any purpose, may disclose the existence of such salts. This is true particularly in regions where rock-salt deposits are known to exist. It is highly desirable, therefore, that persons engaged in boring operations have this possibility always in mind and carefully examine all material brought up by the drill. The Bureau of Soils of the Department of Agriculture will analyze, free of charge, any samples of this kind.

In western Nebraska there are a number of small lakes or ponds whose waters contain considerable quantities of potassium carbonate. These lakes are now being worked, and carbonate of potash containing about 28% K_2O is being marketed. The public statement was recently made by the American representative of the German syndicate that these Nebraskan lakes were furnishing about half the potash now being produced in the country. In working these lakes, brine is pumped to the mill, where it is evaporated down to wet salts in vacuum-pans. These wet salts are then passed through rotary driers, and are ready for shipment. While the size of these lakes precludes the possibility of their ever furnishing a large supply of potash, it is to be hoped that the operators will succeed in perfecting their processes so as to be able to continue production upon a return to normal conditions.

Alunite. In the south-central part of Utah, near Marysvale, there is a large deposit of the mineral alunite, an aluminum-potassium sulphate, from which potassium sulphate and alumina may be extracted after roasting at moderate temperatures. The technical difficulties of extraction are not serious, and in time alunite should become a valuable source of potash for the country. That the mines can be worked commercially for the potash alone is doubtful, however. The deposits occur in mountainous country, necessitating the construction of expensive tramways to bring the ore to the mill, and, once extracted, the potash salts must be carried East by rail, entailing heavy freight-cost. Therefore a market must be found for the alumina as well as the potash.

Under the abnormal conditions brought about by the European war two companies have entered this field, and sulphate of potash from alunite actually has been shipped. It is doubtful if these companies could continue operating on their present systems under normal conditions and with potash selling at the figures quoted before the War. That many millions of tons of potash may be derived from this source, however, when the problems now confronting the operators have been solved, seems reasonably certain.

Searles Lake. A brine deposit in the Desert Basin area probably will prove of some importance as a commercial source of potash. This is the so-called Searles Lake, in California, a body of mud and crystalline salt, some 12 square miles in area and of undetermined depth. Beneath the surface are saline muds and sands saturated with brine which contains 7% of potash in the total solids. Recently it was announced that the persons claiming title to the property would proceed at once to exploit it commercially. So far, however, potash from this source has not been produced in any quantity. That Searles Lake brine ultimately will prove a valuable source of soluble potash seems highly probable. It has been estimated that it will furnish at least 4,000,000 tons of potassium chloride, and probably considerably more.

The waters of Great Salt Lake and other natural brine bodies contain potash in small proportions. No method has been devised by which the potash may be recovered at a price which will permit competition with German salts. It is possible that such a method may be discovered, however, in which event a source of potash will be opened large enough to supply this country's needs for many years.

Kelp. Along the Pacific Coast of North America, from Magdalena bay, in Lower California, to the Shumagin islands of the Alaskan peninsula, are found beds of giant kelp of several species. These huge sea plants, sometimes growing to a length of 100 ft., contain a surprising amount of potash salts. Dried kelp of the most important species will run from 25 to 30% of potassium chloride. At present these Pacific kelps appear to be one of the most hopeful sources of an adequate supply of potash for the country's needs. The realization of this hope is, however, like most new enterprises, beset with difficulties.

The beds are close to the shore, almost all of them being, in fact, within the three-mile limit. The kelp is harvested by cutting the upright stem from three to six feet below the surface, which secures not only that portion but also the much larger portion which floats on the surface of the water. The wet kelp contains from 85 to 93% of water. This must be removed. The plants are non-fibrous and of a gummy gelatinous nature, making it difficult, if not impossible, to extract the water by pressure.

Several methods have been suggested for treating these kelps on a commercial scale with a view to their utilization for fertilizer purposes. The simplest is to dry and grind the material and market this ground product for direct application to the soil or for mixing in commercial fertilizers. The drying can be accomplished in rotary driers such as are used for treating garbage and fish refuse, and the dried ground kelp contains 25% potassium chloride, 2% nitrogen, and organic matter of value for improving the physical condition of many soils by the formation of humus. In addition, it possesses excellent mechanical properties for fertilizer-mixing purposes.

If the kelp grew on the Eastern seaboard, close to the regions of large fertilizer demand, this method of treatment probably would be the most economical and satisfactory. Unfortunately, however, the kelp occurs on one side of the country and fertilizers are most extensively used on the other; and while the dried ground kelp will have the benefit of water-rates of transportation via the Panama Canal, about three-fourths of the material so transported consists of practically valueless matter, and the freight-charges probably would prove too heavy an item to permit this method of utilization in the face of competition with German importations. Investigations are now being made in the hope of transplanting the Pacific kelps to the Atlantic coast. If this should be accomplished and the plants established in extensive beds, this dried ground kelp undoubtedly would become an important factor in the fertilizer business.

Another process now being used is to burn the dried kelp and market the ash for its potash content. By this process the valuable nitrogen content is volatilized and

lost, and a small part of the potash content is similarly destroyed. The heat produced in the combustion is also wasted. In addition, freight-charges must be paid on worthless ash, and it is admitted by the companies now using the process that unless further economies are introduced the costs are too great for successful operation under normal conditions.

The process that seems most likely to succeed in commercial practice is to distill the dried kelp in retorts constructed on the general principal of the by-product coke-oven. This results in a charred residue, containing all the potash salts, which may then be recovered by leaching and evaporation. In the process of distillation the nitrogen in the kelp is driven off and recovered in the form of ammonia; combustible gas is evolved in considerable quantities and is available for use as fuel in the retorts and under the evaporating vats, and charcoal and tarry products are recovered, which may be sold or used as fuel. Iodine and some other by-products also may be recovered.

It is probable that some such method of extraction which will conserve and use the heat units evolved in the reaction and save the by-products will prove necessary in the end to make the recovery of potash from kelp a profitable industry under normal conditions. Since the beginning of the War and the stoppage of German potash shipments several large and responsible companies have erected plants on the southern California coast for the treatment of kelp. These companies are producing either dried kelp, which at present prices for potash can be shipped East at a profit despite the long freight-haul, or kelp-ash, which results from burning the dried kelp. One of the companies is using a fermentation process and producing acetone for munition purposes, as well as high-grade potash salts.

However, with the development and demonstration of an economical method of extraction, an American potash industry should grow up on the Pacific coast able to furnish from these giant kelps a supply of high-grade potash salts adequate for all our needs. The Bureau of Soils is at present erecting an experimental plant at Summerland, California, to determine the best methods of extraction. Since most of the beds lie within the three-mile limit, State legislation by California, Oregon, and Washington, and Federal legislation as regards Alaska, is needed to provide protection against reckless and indiscriminate cutting and to furnish leasing regulations under which the private investor who desires to erect a plant for treating kelp may be assured of a supply of raw material free from encroachment by competitors. Efforts are now being made to secure action of this kind by the legislatures of the States interested and by the Federal Congress.

IN LOADING HOLES the primer and powder should be carefully pressed into the hole, but the primer should not be tamped with hard strokes. It is not necessary to use great force in loading, so long as the powder is pressed sufficiently tight to prevent it from falling out.

Nine Months Mining in Ontario

Returns received by the Ontario Bureau of Mines for the nine months ended September 30 are summarized below, compared with the corresponding period of 1917:

	Quantity		Value	
Product	1917	1918	1917	1918
Gold, oz.	.....	.....	$6,754,535	$6,875,766
Silver, oz.	15,236,002	13,145,596	12,001,875	12,500,980
Cobalt, metal, lb.	295,866	317,291	433,739	702,717
Copper, metal, lb.	.....	359,713	.....	79,137
Nickel, metal, lb.	166,921	582,992	67,499	.....
Nickel oxide, lb.	10,831	5,592	3,025	1,731
Cobalt oxide, lb.	276,769	397,728	323,162	572,845
Other cobalt and nickel compounds, lb.	276,217	367,923	30,025	53,784
Molybdenite, lb.	65,827	43,631	83,550	54,671
Lead, lb.	1,080,000	1,291,571	139,948	115,117
Nickel matte, tons	31,064	33,508	15,532,000	20,105,087
Copper matte, tons	15,928	17,052	6,371,200	6,820,785
Copper ore, tons	2,658	16	33,419	318
Iron ore, tons	138,808	154,243	559,099	697,839
Pig-iron, tons	513,232	541,564	9,841,438	14,728,461

GOLD: Production has been well maintained, considering adverse conditions, which have been aggravated rather than improved during 1918. The output—$6,875,766—was produced from 711,185 tons of ore. Hollinger and McIntyre continue to be the largest producers, the output respectively being $4,685,586 and $1,206,875. New producers this year include Davidson at Porcupine, Patricia at Boston Creek, and Lake Shore at Kirkland Lake.

SILVER: Despite a decline in quantity, the output of silver for the period, if maintained for the remainder of the year, will probably equal in value that of any other year. Mines shipping 750,000 oz. or over are given in order: Nipissing, Mining Corporation, Kerr Lake, and O'Brien. Shippers this year include mines that have been idle for some time. Some of these are the Green Meehan at North Cobalt, Silver Eagle and Keeley mines at South Lorrain, and Peterson Lake. Many of the mines are now treating slime and tailing dumps by flotation methods.

REFINERIES: The southern Ontario refineries treated 2758 tons of ore, 1208 tons of concentrate, and 1847 tons of residue, extracting 3,655,975 oz. of silver, in addition to cobalt and nickel in the form of metal, oxides, and other compounds. About one-third of the output of cobalt metal by the Deloro Smelting & Refining Co. was used in the production of 'stellite'. Nickel metal from silver-cobalt-nickel ores was marketed to the extent of 224,787 lb., worth $89,275.

NICKEL-COPPER: The only copper-ore shipment was a trial lot by the Hudson Copper Co. of Havilah. High operating costs, increased freight-rates and smelter charges, and lack of a custom smelter within the Province contribute to make copper mining unprofitable at the present time.

The new Port Colborne refinery of the International Nickel Co., which started last July, up to the end of September had produced 358,205 lb. of nickel and 359,713 lb. of copper. The Copper Cliff and Coniston smelters treated 1,141,089 tons of ore, producing therefrom 64,926 tons of matte containing 33,688 tons of nickel and 17,232 tons of copper.

Topography and Geology of Dredging Areas—I

By CHARLES JANIN

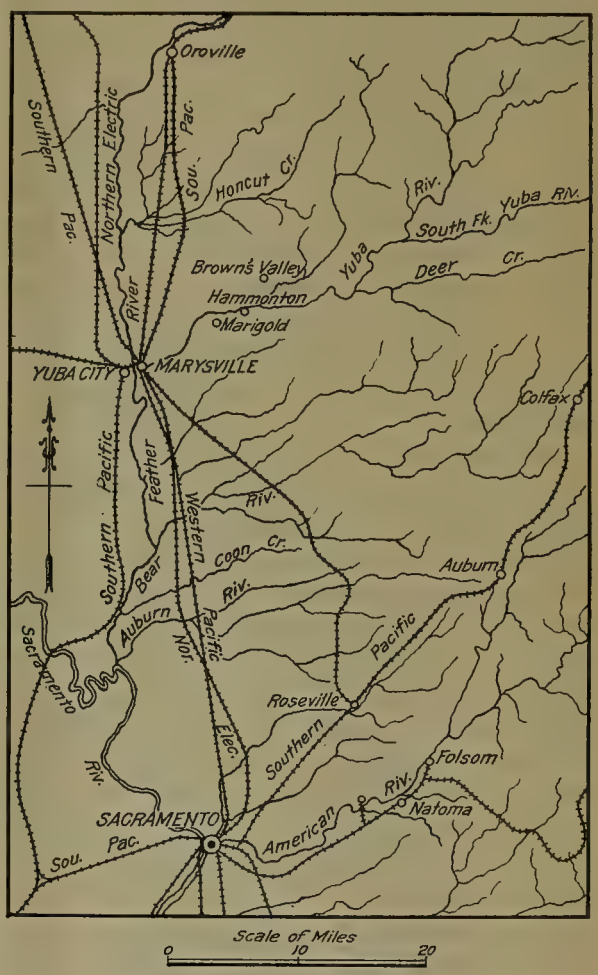
CALIFORNIA. Undoubtedly the placers derive their gold from eroded vein and other deposits in the bedrock. One should remember that a good placer should contain fairly coarse gold, because fine gold does not concentrate as readily and is borne away with the sand. Quartz veins that carry mainly coarse gold are apt to be 'spotty' and uncertain. In the really valuable quartz lodes the gold mainly is fine, either free or in pyrite, and the erosion of such lodes does not result in rich placers. For this reason there is not likely to be any close association between the best quartz-mining districts and the most productive placers. The American and Feather rivers in Placer and Plumas counties have furnished rich placers but are notably poor in quartz mines. The Caribou district of British Columbia and the Klondike have similar characteristics. The Mother Lode region of California has yielded very little placer gold. The Columbia placer district of Tuolumne county, though limited, was one of the richest in California. It adjoins a district that has pockety quartz mines that produced considerable coarse gold—notably the Bonanza mine, which was profitable at times—but has shown no lodes that would maintain profitable mining on an extensive scale.

All the gold of the valley placers is fine as compared with the coarse gold found along the higher courses of the present rivers. Although the finest particles have undoubtedly been carried some distance, the coarse gold has probably not traveled far from where it first lodged. Most of the gold is in fine flat scales that are comparatively easy to recover; but some is as an almost impalpable powder and is carried off in suspension and some is associated with sulphides, or is coated with iron or other oxides, and is lost through failure to amalgamate. Occasionally fair-sized nuggets are found in the dredge-sluices at Breckenridge, Colorado. At the Alta Bert property, in Trinity county, a large part of the gold is relatively coarse.

The principal dredging districts in California are at Oroville on the Feather river; at Daguerre Point, about 12 miles above Marysville, on the Yuba; and at Folsom, on the American river. A smaller district has been worked for some time near Chico in Butte county, and some years ago dredging was tried about Wheatland on the Bear river, but the gravel proved to be poor.

Smaller quantities of gold are dredged in Siskiyou, Trinity, and Shasta counties. Dredges are also busy in Calaveras county, Merced county, and Stanislaus county, and some dredging is being done on the American river above Auburn.

The depth of the gravel ranges from 15 to 18 ft. In part the gravels are coarse, cobbles up to a foot in diameter being by no means uncommon. In Trinity county many of the boulders weigh more than a ton. The gravel contains much sand and clay in places and



PART OF CALIFORNIA, SHOWING PRINCIPAL DREDGING AREAS

is ill sorted. The Oroville gravel almost universally rests on a false bedrock of volcanic tuff or hardpan; some of it lies below the present river-level, and others rest on benches up to 100 ft. above the channels of today. The tuff forms a sheet 12 to 60 ft. thick. At Oroville, and along the Yuba river, there is auriferous gravel below it, but under present conditions this lower gravel cannot be worked.

While the greater proportion of the gold is in contact with or directly above bedrock, gold is by no means

everywhere confined to the lower layers. Gold is often distributed through the gravel or contained in one or more upper beds. Where occasional seams of clay or other material form an impervious layer in otherwise porous gravel, the downward movement of heavy minerals is arrested, and above these layers pay-streaks are formed, a cross-section of a deposit sometimes showing several of them. Where the material is clayey, the gold is likely to be distributed throughout it. As the distance from the mouth of a canyon increases the gold becomes finer and the gravels poorer.*

The Oroville dredging ground, now practically exhausted, comprised about 7000 acres of the plain of Feather river, beginning at the town and continuing to about five miles below, where the ground gradually became poorer. The width varied from less than a mile to about two miles. The average depth of gravel is about 30 ft., increasing to 40 ft. farther down the river. The gravel rests on a false bedrock consisting of a compact tuff containing no large lava pebbles or fragments.

The Feather river, along which the placers lie, flows through a broad valley whose surface is covered with gold-bearing gravels and sands of varying richness and depth. The gold originally came from the gold-bearing quartz veins and old gold-bearing gravels in the mountainous region of the river's upper course, and has been re-deposited with the gravels and sands in the neighborhood of Oroville.

As a whole the placer ground is chiefly heavy gravel, with a top layer of sand or sandy loam. This loam is underlain by a stratum of mixed gravel and sand, and in places by well-defined strata of sand, below which are other strata of coarse or fine gravel and sand, the size of the rock fragments varying from that of a pea to occasional boulders 18 inches in diameter. This mixture of gravel and sand is 20 to 30 ft., and in places 40 ft., thick. Beneath it lies the false bedrock, a tuff or volcanic ash, fairly smooth and regular in contour, and soft enough to dig with the dredge-buckets. In places the placers contain cemented gravel, and in places considerable clay makes washing difficult. Most of the gold is in coarse gravel; here and there some is contained in sand. The gold is fine, and some of it may be called flour-gold. The gold content of the gravel worked ranges from 8 to 35 cents per cubic yard.

The fineness of grain of the gold in the Oroville district is given in the following statement, which represents averages from a number of tests made by screening:

Mesh of screen	%
60 and coarser	58.1
60 to 100	15.3
100 to 120	2.9
120 to 150	2.4
150 and finer	21.1

In the other districts the gold has approximately the same size of grain. Occasionally, as in Trinity and Siskiyou counties, small nuggets having a value of 50 cents to several dollars are found, but in California such nuggets are confined almost entirely to the gravels in those counties. The gold is generally of high grade, its fineness averaging 915 to 930.

The Yuba field, 12 miles from Marysville, at Daguerre Point, is situated where the first greenstone hills of Yuba county emerge from the Quaternary covering on the south side of the river. The available dredging land on Yuba river has a total area of about 6000 acres; it extends along the river for a distance of about seven miles and has a width of nearly two miles.

The ground lies only a little above river-level and is covered to a depth of 40 ft. with the old tailing the river has brought from the hydraulic mines in the mountains. Before this tailing was deposited the low bars rose to a height of 15 to 20 ft. above normal water-level. Above Daguerre Point, on the north side of the river, the gravel rests on the greenstone bedrock, but elsewhere in the area they lie on a stratum of hardpan or compact clay, which on the north side of the river rises to form low rolling hills. Below the clay in places is volcanic tuff, similar to that of Oroville, and probably derived from the same source, namely, the volcano of the Marysville Buttes. The bedrock brought up by the dredges does not usually show the presence of volcanic material.

The Folsom dredging area at the mouth of the canyon of the American river is the largest in the State, comprising about 13,000 acres. From Folsom, in Sacramento county, the district extends mainly along the south side of the river for about seven miles, with a width of one to two miles, forming a wide belt of dredging ground of sandy gravel 20 to 35 ft. deep. In places clay is encountered, but the conditions at Sacramento and Mississippi and on the Kendall and Nuttall tracts are generally satisfactory for dredging. Like the gravel of the bars, this gravel rests on a false bedrock of white volcanic ash, which outcrops in the Orangevale bluff, north of the river, and at other points on higher ground south of the river. Only at two places along Willow creek, within the area actually exploited, does the real bedrock (granite and slate) appear under the gravel.

Farther south and south-west of Folsom is a higher belt of terrace gravel on which the early miners did much shallow hydraulic and drift mining. This belt appears to represent an older channel, which started at Mormon island and Blue Wing ravine and continued along the upper course of Willow creek. Here the channel is 400 ft. wide, and formely was worked at several places through shafts 60 to 80 ft. deep. At Rebel Hill this gravel spreads out considerably and is 50 to 70 ft. deep, the volcanic ash bedrock lying 50 ft. above the river. In this area the formation consists of gravel held tightly together with clay. In places the gravel is cemented and is covered with a fine clayey soil, and for years profitable dredging was thought to be impossible there. The conditions for work are unfavorable, as the digging is hard, and the clay makes washing difficult. There are two principal pay-streaks; one is 34 ft. below the surface, the second, at 50 ft. or more, rests on the false bedrock.

*For a discussion of the California placers, see Lindgren, Waldemar, 'The Tertiary Gravels of the Sierra Nevada of California': U. S. Geol. Survey Prof. Paper 73, 1911, 220 pp.

ALASKA

Volney Richmond, superintendent of the Northern Commercial Co., recently at Dawson, Yukon, en route to San Francisco, after having toured the lower Yukon camps for several weeks, gives the following estimate of the gold yield for the present season, based upon figures kept by reliable authorities in the region:

Iditarod	$1,500,000
Fairbanks	1,000,000
Tolovana	900,000
Ruby	250,000
Marshall	200,000
Hot Springs	150,000
Koyukuk	140,000
Circle	100,000
Rampart	30,000
Total	$4,270,000

MAP OF ALASKA, SHOWING SITUATION OF THE DISTRICTS ENUMERATED BELOW

The principal mining districts are indicated in the numbered circles, as follows: (1) Port Dick; (2) Sunrise; (3) Resurrection; (4) Falls Creek; (5) Latouche; (6) Bering River coal; (7) Valdez; (8) Illiamma; (9) Bonanza; (10) Matanuska coal; (11) Willow Creek; (12) Yentna; (13) and (14) Placers; (15) Broad Pass; (16) Nenana coal; (17) Kantishna; (18) Hot Springs; (19) Fairbanks; (20) Circle; (21) Rampart; (22) Chandlar; (23) Eagle; (24) Koyukuk; (25) Kuskokwim; (26) Ruby; (27) Ophir; (28) Iditarod; (29) Georgetown; (30) Nulato coal; (31), (32), and (33) Seward Peninsula.—Map from 'All Alaska Review' of Seward.

Mr. Richmond estimated that these figures are only 50% of normal. The figures were gathered from interior operators, bankers, and others in close touch. The falling-off is due largely to men being called away to war and to the fact that the ground is low grade and will not pay to work during the period of high costs.

He estimated that the Tanana valley this winter will have 3500 people; Iditarod, 400; Ruby, 250; Koyukuk, 150; and Marshall, 100. Possibly there will be 1000 persons on the Seward peninsula, including Nome. All these figures are probably 50% below normal. Nome was hard hit early in the season by reason of the fact that the 40 dredges of that country shut-down at the beginning of the season. It seems that the employees there went on strike for more wages and shorter hours at the opening of the season, and the operators, knowing that they could not pay more wages when costs of food and material were so high and gold lost its purchasing power, refused to grant the increase. They simply shut-down and remained so all season. At Nenana about 700 men are at work for the Government railway, and 700 more people are in the town and vicinity. The railway is extended out 40 miles from the town and construction is continuing under direction of Mr. Brown, who seems to be making a good record. Work is also under way on the Fairbanks-Nenana section. One of the best producing properties in the Iditarod this year was that owned by Perry Ford and Al Walsh and worked on a 'lay' by Walsh and Tom Aitken. It produced $84,000. The property is on a high hill.

The Mines Report—covering gold silver, copper, and lead in Alaska in 1917—by G. C. Martin, has just been issued by the U. S. Geological Survey. Final figures were $14,657,353 of gold, 1,239,150 oz. of silver, 88,793,400 lb. of copper, and 852 tons of lead, all, save lead, considerable decreases. Lode mines contributed 28.5% of the total gold. Fairbanks district placer operations recovered 63,371 oz. of gold, compared with 87,075 oz. in 1916, and 466,819 oz. in 1909. Lode mining there reported 1200 oz., against 12,237 oz. in 1913. Seward Peninsula placers saved $2,600,000, a decrease of $350,000 when compared with 1916.

Juneau.—Alaska Gold Mines during the third quarter of 1918 operated at a loss of $11,984. For 9 months the deficit is $34,250; in 1917 this period showed a profit of $236,011.

Kennecott.—The Mother Lode Copper Mining Co. has had an injunction granted against it by the Supreme Court at Seattle, preventing the company from completing sale of its property to the Mother Lode Coalition Mines Co. (organized by the Kennecott Copper Corporation). A minority shareholder brought up the action. The Court held that there was a defect in the notice sent out by the Mother Lode to shareholders, notifying them of a special meeting to be held on July 1, last, for the purpose of ratifying sale of the mine to the Coalition company.

ARIZONA

Bisbee.—Calumet & Arizona pays $2 per share on December 23. This makes $8 for 1918, against $11 in 1917, $9 in 1916, and $3.25 in 1915.

The Wolverine mine is shipping a carload of ore daily.

At the Boras lease, 8% copper ore has been cut on the 200-ft. level.

Ground south and west of the White Tail Deer property of the Copper Queen is being opened by a local syndicate.

The mine warehouse of the Copper Queen was burned recently, handicapping operations considerably.

Humboldt.—Consolidated Arizona Smelting pays a dividend of 1%, equal to $83,150, on December 17.

Jerome.—United Verde Extension produced 4,702,500 lb. of copper in October, slightly less than in September.

CALIFORNIA

Oil production of the State in October amounted to 282,433 bbl. daily, an increase of 6276 bbl. over the September output. There were 61 new rigs, 359 wells drilling, 50 completed, 6 abandoned, and 8448 producing. The 50 new wells are yielding 13,297 bbl. daily. Stocks in fields and pipe-lines totaled 36,562,897 bbl. on October 1 and 37,400,859 bbl. on November 1.

Redding.—The Mammoth Copper Co. has made a final payment of $32,000 on the $40,000 purchase price for the Keystone group of nine copper claims lying between the Balaklala and Stowell mines, all near the Mammoth. The owners of the Keystone were William Slemmer, Dr. George A. Grotefend, and Robert Stevenson. The Mammoth took an option a year ago. Since then diamond-drills have revealed the extent of the orebodies, and shipments of ore have been made to the company's smelter at Kennett.

Shawmut.—Owing to shortage of labor the Eagle-Shawmut gold mine has been closed until the situation improves. Unless the mill treats 400 tons daily the company finds it uneconomical to work.

COLORADO

Alta.—The Belmont Wagner company lost 67 men through influenza, and is generally short of men. The economic milling capacity is 300 tons daily, so until conditions improve the management is considering the expediency of continuing operations.

Breckenridge.—Owing to abnormal conditions—war and influenza—the Wellington Mines Co. has only 85 men at work, against a normal force of 125. The mill is making high-grade zinc and lead concentrate. R. H. Henderson is in charge.

Cripple Creek.—Cresson Consolidated pays 10c. per share, equal to $122,000, on December 10. This distribution is "from funds received from the sale of ore-reserves acquired prior to March 1, 1913." The total to date is $7,149,163.

Influenza is still handicapping operations in this district, and few mines are working to capacity.

An important discovery for the Ironclad Hill area has been made by S. A. Denman, lessee, and former superintendent for the Cripple Creek Deep Leasing Co., at a depth of 950 ft. in the mine of the Jerry Johnson Gold Mining Co. An ore-shoot has been opened so far a distance of 20 ft. Samples return from $30 to $140 per ton. The first car shipped, with little sorting, returned $30 per ton. Two cars loaded out this week are estimated to carry 2 oz. per ton. The Jerry Johnson shaft is the deepest on Ironclad hill, and already operators on other properties adjoining the Forest Queen and W. P. H. are making preparations to sink.

Mine gas, which prevented work in the Forest Queen mine during October—when only seven full shifts were worked—has been successfully combated by the general manager, E. Gaylord. The drift on the 650-ft. level has been bulkheaded, and before the men are lowered to work the compressor is connected with a ¼-in. pipe, entering the drift over the bulkhead. The gas is thus forced back into the rock after 30 minutes. The Forest Queen is now working continuously and producing. The shaft is to be sunk to the 1000-ft. point.

The property of the Yellow Bird Gold Mining Co. on Gold hill, was sold by the Sheriff of Teller county on November 23, under a judgment entered in the District Court in favor of Hildreth Frost, in the sum of $3093 and costs. The judgment creditor was the purchaser.

Red Mountain.—The re-organized Henrietta company, under the management of Edward Walter, will early next year drive a tunnel from the Cement creek (San Juan) side of Red mountain through the mountain at a depth to cor-

respond with the Joker tunnel, with which it will probably be connected on the Ouray side. The Henrietta will be prospected thereby at a depth of 2000 ft. Other properties will benefit by this new work.

IDAHO

Kellogg.—The manager of the Nabob company, William Beaudry, states that a 150-ton mill is to be erected at the mine on Pine creek at an early date. The ore carries zinc, lead, and silver. The Stewart Mining Co. controls the Nabob.

MICHIGAN

Houghton.—Dividends declared payable on December 31 are as follows, per share:

Company	December 31	In 1917	In 1918
Ahmeek	$2.00	$10.00	$16.00
Allouez	1.50	7.50	12.00
Calumet & Hecla	15.00	55.00	85.00
Centennial	1.00	2.00	....
Isle Royale	0.50	2.50	....
Osceola	2.00	10.00	20.00
Quincy	*2.00	8.50	18.00
Wolverine	†1.00	4.00	13.50

*December 23. †January 2.

Mohawk produced 787,149 lb. of copper during October. This was equal to 1.04% ore. Returns this year have varied from 1,088,654 to 711,129 lb. per month.

Wolverine yielded 293,070 lb. in October. Since February, excepting September, there has been a regular decline from the total of 403,736 lb. Ore is yielding only 0.503% copper.

MISSOURI

Joplin.—Production of the Tri-State region last week was 4497 tons of blende, 520 tons of calamine, and 958 tons of lead, averaging $58, $38, and $100 per ton, respectively. Total value was $383,252. Missouri contributed $96,809. There is said to be a stock of 20,000 tons. The movement for an absolute shut-down of the mines in order to absorb the surplus has been changed to what producers believe will prove a more satisfactory arrangement. The smelters have agreed to state in advance how much concentrate they will buy, and the producers' committee will allocate the business to the various mines.

MONTANA

Butte.—The report of Butte & Superior for the third quarter of 1918 shows receipts totaling $1,479,949; operating charges, taxes, etc., $1,334,502; and profit, $145,447. In the previous period the profit was $95,320. Shortage of labor resulted in a lower tonnage mined. Costs advanced owing to increased wages, lower efficiency, etc. The mill concentrated 108,182 tons of ore assaying 15.647% zinc and 6.331 oz. silver. Concentrate contained 51.97% Zn. The total output of metal was 15,426 tons.

Great Falls.—The rolling-mill of the Anaconda company is to make 600 tons of ¼-in. rods for the British government.

NEVADA

Ely.—Nevada Consolidated reports as follows for the third quarter of 1918:

Profit	$890,293
Dividend paid September 30	1,499,593
Red Cross contribution	30,000
Deficit	$639,300
Current assets	16,127,851
Ore milled, tons	1,003,898
Copper content, per cent	1.50
Copper output, pounds	18,643,216
Cost per pound, cents	20.70

The output was nearly 3,000,000 lb. less than in the preceding period. Of the ore, 64% was from Copper Flat and 36% from the Ruth mine. Costs are 3 cents per pound more than before, due to well-known causes.

Goldfield.—Ten lessees are working at the Florence, making occasional shipments to smelters. Lessees in the early days made large profits. At present all pay a 25% royalty. The company rents to them the whole plant, while they pay for supplies, air, and hoisting.

A raise from the 910-ft. level of the Spearhead shows the new shoot to have widened from 2 to 4 ft., the ore still being of high value. Large transactions in shares have taken place on the Stock Exchange at San Francisco, 353,000 changing hands on November 29. The movement in price was from 9 to 7c., then 7 to 16c., closing at 14 cents. On December 2 the shares rose to 27 cents.

The Crackerjack has secured a lease on 35 acres of the Goldfield Consolidated and 15 acres of the Florence.

Ludwig.—Nevada-Douglas mines produced 300,000 lb. of copper in October. Ore sent to the Thompson smelter during the last week of the month amounted to 1150 tons, averaging 3.9%. In the Casting Copper mine, a winze below the 350-ft. level is in 6% ore; in the Western Nevada the 400-ft. level shows 6 ft. of 13.5% ore; and the 700 and 800-ft. levels of the Ludwig, adjacent to the caved stope, show 4 and 5% ore. There are 121 men employed.

Tonopah.—Last week's output of the district was 7189 tons valued at $122,213.

Additional returns for October were:

Mine	Tons	Silver, oz.	Gold, oz.	Profit
Tonopah Extension	9,867	122,076	1,125	$56,542
Tonopah Mining	11,460	106,050	1,004	43,153

The Extension profit is the largest for several months. A dividend of 5c. per share is payable on January 1.

OKLAHOMA

Picher.—Oklahoma fields last week produced 3351 tons of blende and 829 tons of lead, valued at $277,203.

It is said that high royalties demanded from lessees is making it difficult to mine zinc ore profitably. Some royalties run from 15 to 30%, of which the land-owner received from 5 to 10%.

The Oklahoma Ore Storage Association is ready for business. Arrangements have been completed whereby 90% of the average value of the price of the ore placed in the warehouses will be advanced to the owners where desired. Ore will be received after December 1. Every bank in the various districts is behind the movement.

TEXAS

Boquillas.—The Ellis Quicksilver Co. is to erect a furnace and other equipment at its cinnabar mines near this place.

UTAH

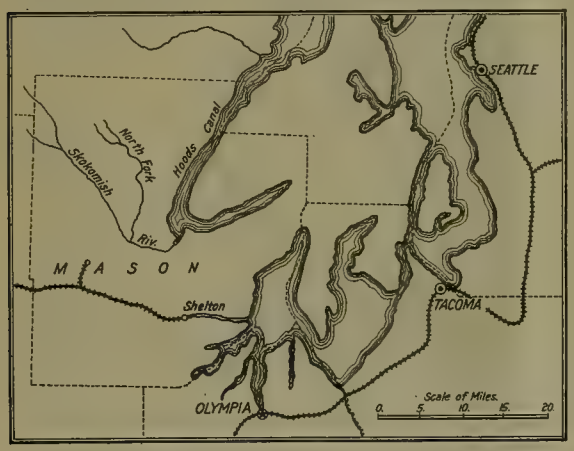
Bingham.—The apex dispute between the Utah Consolidated and Utah Metal company is reported in Salt Lake City to have been settled out of court. The engineers employed are said to have decided that the Utah Metal really had apex rights to the orebodies disputed, so the Utah Consolidated agreed to acquire them. This settlement will have an important bearing on the apex suit pending between Utah Consolidated and the Utah Apex company.

WASHINGTON

The manganiferous area in Mason county, in the Olympic region, which had been examined hastily in 1917, was revisited by J. T. Pardee, of the U. S. Geological Survey, in August 1918. Mr. Pardee also examined several outcrops on the South fork of Skokomish river that had not heretofore been examined and, in company with Henry Landes, director of the Washington Geological Survey, visited some deposits along the North fork. In addition, the Tubal Cain mine, on Copper creek, a tributary of Dungeness river, 25 miles north-east of the Skokomish River deposits, was examined from July 25 to 30, 1918, by Mr. Landes, who has

made the results of his work available to the Federal Survey.

The geologic relations of all the deposits examined are similar. The lodes occur in regionally metamorphosed rocks of probable Jurassic age—greenstones, argillite or slate, and limestone. The greenstones are altered basic lavas and intrusive rocks and form the bulk of the series. The limestone is strongly discolored with iron and manganese oxides, and is closely associated with most of the lodes. The lodes resemble one another in nearly all their features. They are lenslike masses, composed mainly of an uncommon brown hydrous silicate of manganese with which is associated a red jaspery quartz, hematite, and traces of rhodonite, the common silicate of manganese. The manganese minerals are weathered to the common black oxides of manganese to a depth of several feet below the surface. The hydrous silicate of manganese is pale brown material having the fine texture of porcelain and breaks with a con-



THE MANGANESE DEPOSITS DESCRIBED ARE NEAR THE SKOKOMISH RIVER, WASHINGTON.

choidal fracture. Is closely resembles common varieties of hornstone and flint, with which, except for its weight, it might easily be confused. An unweathered specimen from the Black and White group of claims, 18 miles north-west of Hoodsport, contained 46.37% manganese oxide, 23.68% silica, 3.48% alumina, 3.52% ferric oxide, 1.31% magnesia, and 1.56% lime. Although this analysis may not represent the average composition of the largest masses, the unweathered bodies probably contain a large proportion of material having approximately the composition given.

The Tubal Cain deposit consists of bands and lenses of brown silicate developed in a red limestone that forms a practically continuous lode at least 1500 ft. long. The outcrop attains an elevation of 6300 ft., and most of it lies above timber-line, so that the exposures are exceptionally good. The orebody averages 6 ft. in width, and natural cross-sections show that it persists to a depth of at least 500 ft. The part of the body seen is estimated to contain 450,000 tons of ore. The oxidized part is thin, commonly forming but a mere surface shell an inch or two thick.

The outcrops of the deposits along the South fork of Skokomish river are below timber-line and are therefore poorly exposed. The largest body seen is evidently continuous for a length of 200 ft. or more, and for a depth of at least 100 ft. and shows an average width of 8 ft. of ore, and therefore probably contains about 16,000 tons. Another body is 15 ft. wide, but is exposed only for 50 ft. It contains at least 2500 tons. Some smaller exposures represent bodies containing perhaps 2500 tons more. Eight or ten other outcrops that are reported to be similar to those described, were not visited. The bodies examined are probably not limited to their natural exposures, which, as is suggested by the persistence of the Tubal Cain deposit, are only small parts of them, but in the absence of trenches or other workings it is not possible to estimate more exactly their content of ore. Here, as elsewhere, the black oxides, in places at least, form but a thin shell over the brown silicate near the surface.

On the North fork of Skokomish river, at the Triple Trip mine, the workings show a reserve consisting of a small lens of manganese minerals, chiefly the brown silicate. MacKean's claim, which adjoins the Triple Trip, contains a body at least 6 ft. wide and 40 ft. long. On the Apex claim above MacKean's, an open-cut shows 10 ft. of manganese minerals in a lode that is 30 ft. wide, the remainder being red jasper and hematite. At this cut, part oxidation extends to a depth of 6 ft. or more and a particularly interesting oxide occurs in considerable amounts. It is compact, hard, and heavy, and dark green, and therefore should perhaps be classified as the mineral manganosite, an uncommon oxide of manganese. The orebodies on the North fork are not yet sufficiently exposed by workings to warrant estimates of their content of ore, but the natural exposures there warrant an estimate of several thousand tons of ore.

It is evident that the quantity of silicate ore available in the Olympic region is large, and it may perhaps be measured by hundreds of thousands of tons. None of the manganiferous bodies in this region except some on the North fork of Skokomish river have yet been explored. A large amount of development on a supposed copper lode at the Tubal Cain deposit does not exploit the manganiferous orebody.

The deposits on the North fork are more easily accessible than any others here mentioned. The Triple Trip can be reached by a good auto-road from Hoodsport, and by a good road, recently completed, from Lake Cushman, 6 miles away. The railway of the Phoenix Logging Co. has been carried to the lower end of Lake Cushman and, it is said, is soon to be extended to the mine. Although the deposits on the South fork are but 6 miles in a straight line from the Triple Trip, the country is so rough they can be reached, even on horseback, only by a circuitous route covering 20 miles or more. A wagon-road could doubtless be built up the South fork, but it would have to climb over two or three high points or cross the stream several times. The size and the elevation of masses of stranded driftwood along the stream indicate that a permanent bridge across it would be rather expensive. If the deposits at the Triple Trip should prove to be workable, a wire rope or other form of tramway across the mountains would perhaps be the most practicable means of transporting ore from them. Although the visible ores of the Olympic mountains are more silicious than ores from which ferro-manganese is commonly made and cannot therefore be smelted advantageously in the blast-furnace, they could be melted to silico-manganese and to standard grades of ferro-manganese in electric furnaces if cheap electric power were available and other conditions were favorable. H. H. Piper of Olympia has two men at work on the Apex claim. In association with Mr. MacKean he proposes to erect a small electric furnace at the foot of the mountains to make ferro-manganese from ore from the Apex and adjacent claims.

CANADA

British Columbia

Anyox.—Granby Consolidated produced 1,932,870 lb. from its mines here in October, and 616,604 lb. at Grand Forks, a total of 2,549,474 lb. This is a drop of 820,000 lb. from September.

Kamloops.—The well-known Homestake silver mine has been sold to La Rose company, of Cobalt, Ontario. This is the second Cobalt company to enter this Province, the Min-

ing Corporation having recently acquired the Woolsey property near Revelstoke. The Homestake was disposed of by Byron R. Jones and associates of Vancouver, who had secured the property under option. This mine was operated 22 years ago, but its then owners were unable with the processes then in use to extract more 70%; so work was suspended. With present methods the Homestake should be among the producers again. H. D. Cameron will be in charge. The Homestake is situated in the Kamloops mining division, 18 miles from the Canadian Northern Pacific railway, at an elevation of 2600 ft. It consists of four crown-granted mineral claims, or 191.44 acres. A 190-ft. tunnel has been driven. Samples taken last year from the vein at the mouth assayed 7.78 oz. silver, 0.22% copper, with a little gold.

Nelson.—The Queen, Vancouver, Kootenay Belle, and Alexandra mining claims, on Sheep creek, have been consolidated under control of A. W. McCune of New York. For some time it has been the opinion of engineers that these properties would have to be placed under one management to be successfully operated. Sheep Creek has been a producer of gold since 1900. The Queen has yielded metal from 1900 up to two years ago, when, as a direct result of labor difficulties, operations were suspended. In that time the camp produced $2,500,000, of which the Queen was responsible for $1,312,654 and the Kootenay Belle, $104,972. Work has been commenced upon the portal of a 3000-ft. cross-cut tunnel, commencing at the Malwaaz (one of the claims) running south-east across the several properties to the Alexandra. This is expected to cut several parallel veins. The new pipe-line from the compressor to the new portal is also under way. About 25 men are being employed, this number to be increased to 200. New development will entail an expenditure of over $200,000. The erection of a 200-ton mill, replacing the old Queen plant, is contemplated, and buildings are being remodeled and renovated. A power-line and telephone service with Nelson are being arranged. The manager in charge is Marcus M. McCune.

Princeton.—The Voight copper property on Copper mountain, near here, has been acquired by the Consolidated Mining & Smelting Co. This is one of the best known low-grade properties in the Province, the claims covering 6000 acres. They have been in the possession of Emil Voight for several years.

Trail.—Ores received at the smelter here during the first 9 months of the current year totaled 271,417 tons, compared with 327,639 in 1917, and 415,983 in 1916.

Yale.—The Snowstorm group of five highly-mineralized copper-silver-gold claims, situated in Highland valley, will be prospected by the Provincial Department of Mines by diamond-drilling under the terms of the Mineral Survey and Development Act. Announcement to this effect has been made by Hon. William Sloan, Minister of Mines, and tenders are being invited for 10,000 ft. of drilling.

The International Diamond Drill Contracting Company of Spokane, has been awarded a contract by the Minister of Mines of British Columbia for 10,000 ft. of drilling on the Snowstorm group of copper-silver-gold claims, in Highland valley. This is the same company that has been engaged in the exploration of Copper mountain for the British Columbia Copper Co., for which concern it drilled a total of 100,000 ft. The Government work will start at an early date.

Ontario

Cobalt.—Kerr Lake produced 200,220 oz. of silver in October, rather below recent months.

Nipissing yielded silver worth $278,468 in October. This is the highest output since July, when it was 304,694. There was treated 178 tons of high and 6882 tons of low-grade ore. The refinery shipped 401,423 oz., including custom metal. On No. 4 level of No. 73 shaft the vein has widened from 1 to 4 in., assaying up to 3000 oz. per ton. At 96 tunnel two soft veins, 2 in. wide, were cut, carrying 1500 oz. Other developments were satisfactory.

Kirkland Lake.—The Lake Shore company pays a dividend of 2½%, equal to $50,000, on December 10. The company also subscribed $50,000 to the Victory Loan. Since the mill started in March it has treated 13,128 tons of gold ore worth $325,550.

Porcupine.—The Schumacher Mines is to issue 100,000 treasury shares. During the year ended March 31, 1918, a loss of $7695 was made; while from April 1 to July 15, 1918, there was a profit of $8675. Current assets on March 31 were $51,379, and liabilities $54,992. The mill capacity was increased to 180 tons per day, while machine-drills were increased from 14 to 25. These additions cost $50,981. The two periods compare as under:

	12 months	4½ months
Ore treated, tons	.....	45,373
Average value per ton	.....	$5.71
Gold extracted	$202,387	$242,060
Profit or loss	−7,695	+8,675
Cost per ton	.....	5.15

Ore-reserves in July were valued at $600,000.

The Schumacher has decided to sink its shaft from 1000 to 1200 ft. depth.

The Hollinger Consolidated company has subscribed $1,750,000 to the Victory Loan. The company pays a dividend of 1% on December 2. This is equal to $246,000, and makes $984,000 for 1918, and $9,018,000 to date.

Sudbury.—The International Nickel Co., in the six months ended September 30, 1918, reports earnings of $7,809,342. Deducting $381,843 for administration and general, $2,749,126 reserve for taxes, and $995,090 for depreciation and mineral exhaustion, the profit left was $3,683,283. Preferred shareholders received $267,378, and common shareholders $1,673,384.

MEXICO

Chihuahua

Juarez.—According to business-men in Mexico, both American and Mexican gold money are comparatively plentiful in Juarez and Chihuahua. In September and even later American gold was at a premium of 10%, and is now down to about 1%, according to the 'El Paso Herald'. Mexican gold was selling a short while ago at a premium of 13% or 63 cents for a Mexican peso, but the premium is now down to 2%. It has been and is cheaper to buy American gold than Mexican. Operators across the line have been doing this. Of course they could get the gold from their banks on this side to pay operating expenses in Mexico, as the United States government gave permits for such export to Mexico, and this accounts for the increase of the quantity of American gold money. Carranza's presidential decree for American gold to pass at the rate of one for two of Mexican gold is another factor in making the premium lower than the latter, say those doing business in that country. It is also thought that the possible early release of gold after the signing of the armistice in Europe is a factor in lowering the premium on coin of that metal in Mexico. Another thing attributed by men doing business in Mexico to the prospective early improvement of business and other conditions after peace in Europe is the increasing value in the market of the price of the bills of the old banks of issue in Mexico. The bills that have been quoted the highest right along are those of the Banco Nacional, now up about 22 cents gold. A few of the other banks' bills have been rising slowly also. Still another kind of Mexican money also rising in value slightly is the 'infalsificables', or 'uncounterfeitable' money issued by Carranza. To withdraw this money from circula-

tion, Carranza had issued a decree that with every peso of duties paid in gold there should be with it one peso of 'infalsificado.' The result is a growing scarcity, and that class of money has advanced from half a cent gold per peso to two cents or better.

Santa Eulalia.—G. M. Hillard and associates who are working the El Cristo mine in this district, are making regular shipments of ore to the A. S. & R. smelter at Chihuahua. It is stated that ore recently opened carries over 1200 oz. silver and 60% lead. Before passing into the hands of the present owners, El Cristo is said to have produced more than $3,000,000 of ore.

Mexico

Mexico City.—In a report just issued by the Department of Industry, Commerce and Labor, statistics are given of the mineral production of this country for the year 1917. There are in Mexico a total of 25,063 mining properties. The gold and silver mines are most numerous, totaling 9840; silver mines total 5804; lead and silver, 4281; and gold, 1800. One mine produces jacinet, nine mines opals, one bismuth, two rock-salt, fifty-three sulphur, thirty-nine manganese, two molybdenite, one fluorspar, and one hundred and nineteen mines produce mercury. The State of Mexico occupied first place in gold production, having yielded 68,000 oz.; Hidalgo was next with 59,000 oz.; and though in former times it was famous for its output of gold-bearing ores, Guanajuato produced only 300 oz. Hidalgo took first place in the output of silver, with 10,750,000 oz.; Aguascalientes was next with 3,300,000 oz. The output of all the mines, in kilogrammes, was as follows: gold, 5788; silver, 648,684; copper, 141,528; lead, 26,769; zinc, 3388; and antimony, 2140.

Sonora

Cananea.—Greene Cananea Copper Co. paid $2 per share, on the $100 shares only, on November 25.

KOREA

Unsan.—Gold production of the Oriental Consolidated in October was $92,000.

LOCAL SECTION A. I. M. E.

L. D. Ricketts will address the local section of the A. I. M. E. in San Francisco on December 10, and exhibit the films showing operations at the New Cornelia and Inspiration mines. These films are unusually fine and, with the descriptions to be given by Dr. Ricketts, should prove interesting.

A local branch of the American Zinc Institute is to be organized at Picher, Oklahoma, as decided by a large meeting of mine-owners two weeks ago.

Obituary

George Reinmiller, assistant superintendent for the Engels Copper Mining Co., died of influenza on November 7 at the mine, in Plumas county, California.

Robert M. Green, manager for the Butte Copper Czar Mining Co., at Butte, Montana, died from the after-effects of influenza.

Bruce White, one of the first prospectors and mine operators in the Slocan district of British Columbia, died on November 15 at the Kootenay Lake hospital of pneumonia following an attack of influenza.

Benjamin Harrison Dosenbach, consulting flotation engineer for all the companies under Mr. Jackling's direction, died at his home at Butte on November 26 from an attack of pneumonia following influenza. He was a graduate of the Missouri School of Mines, '09, and was married only a few months ago. His untimely death will be deeply regretted by a large circle of friends.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

J. R. Finlay is at Tucson, Arizona.

John Hoffmann has returned to Oakland from Siberia.

M. H. Burnham, of New York, was in San Francisco this week.

Dalby B. Morkill, formerly at Hazelton, is now at Vancouver, B. C.

T. H. Jenks, consulting engineer of Phoenix, Arizona, is at the Chancellor hotel.

C. C. Gordon passed through San Francisco on his way from Lima, Peru, to New York.

Frank L. Cole, of Shanghai, arrived in San Francisco on the 'Korea', on his way to New York.

A. B. Howe has resigned as secretary-treasurer of the Goldfield Consolidated Mines Company.

A. W. Stickney is making an economic examination of the island of Cyprus for a British syndicate.

Blamey Stevens, who was in San Francisco last week, will return shortly from Los Angeles to Nogales.

W. L. Honnold, until recently director at New York of the Commission for Relief in Belgium, is now residing in Paris.

J. Power Hutchins, who was attacked by influenza on his arrival in San Francisco, is convalescing satisfactorily at Del Monte, California.

C. W. Adams, assistant superintendent of the Murray plant of the A. S. & R. Co. at Salt Lake City is making a visit in San Francisco.

Henry Smeddle, Captain in the 15th Battalion, B. E. F., has been awarded the Military Cross and promoted to second in command of the 25th Battalion.

William McMahan, formerly with the Granby company, has been promoted to Second Lieutenant in the Corps of Engineers, U. S. A., 49th Co., 20th Engineers.

Henry Schnitzel, general manager for the Golden Reward Consolidated at Deadwood, South Dakota, is in California. He is interested in placer ground near Nevada City.

A. H. Brown has resigned from the management of the Hudson Bay Mines, at Cobalt, and the Dome Lake M. & M. Co., at South Porcupine, to take up other work in January.

E. B. Thornhill has resigned as manager of the New York office of the General Engineering Co. to take a position with the Chino Copper Co. as research engineer, effective December 1.

Edgar Rickard has been appointed chairman of the executive committee of the Commission for Relief in Belgium. He continues to be Mr. Hoover's chief assistant in the Food Administration.

Forest Rutherford, consulting metallurgical engineer, has returned to New York from Colorado, where he spent the summer months making mill-tests on some interesting ores from the Breckenridge district.

L. J. Mayreis, formerly assistant-manager for the Burma Mines, Ltd., has been made manager of the new zinc smelter and sulphuric acid works that the Burma Corporation is building at Sackchi, in India.

Roy H. Allen, recently said to have been commissioned Captain in the Quartermaster Department of the Aviation Service, is Captain in the Aircraft Production department of the Air Service and is stationed at Dayton, Ohio.

THE METAL MARKET

METAL PRICES

San Francisco, December 3

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	10.00
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	7 30— 7.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	10.50
Zinc-dust, cents per pound	16.00

ORE PRICES

December 3

Chrome, no definite quotations available.	
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$1.25
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$20—$26

EASTERN METAL MARKET

(By wire from New York)

December 3.—Copper is unchanged, but casting copper is quoted at 23c. Price of lead was reduced on December 2 to 7.05c. Spelter is dull though steady.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government has fixed its maximum at 49½ pence.

Date	New York,	London	Average week ending	
Nov. 27	101.12	49.50	Oct. 22	101.12
" 28 Holiday			" 29	101.12
" 29	101.12	49.50	Nov. 4	101.12
" 30	101.12	49.50	" 12	101.12
Dec. 1 Sunday			" 19	101.12
" 2	101.12	49.50	" 26	101.12
" 3	101.12	49.50	Dec. 3	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	6[illegible].86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	101.12
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Writing on November 9, Samuel Montagu & Co. of London say that no change has taken place in the state of the silver market, though the recent reduction in insurance rates will doubtless be reflected in the price of silver. News has been cabled officially from India that the weather outlook is gloomy. It is stated that rain is insufficient everywhere, and that famine conditions are expected in the Bombay presidency. By mail leaving Bombay on September 18 it was stated that a moderate amount of silver in the shape of ornaments was then arriving from up country for realization, owing to the insufficient rainfall. At present the untoward course of events does not seem to be shown in the currency returns, where the silver holding from week to week increases but slowly, notwithstanding fresh purchases in America.

LEAD

Lead is quoted in cents per pound. New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York. This was reduced to 7.05c. on December 2.

Date		Average week ending	
Nov. 27	8.05	Oct. 22	8.05
" 28 Holiday		" 29	8.05
" 29	8.05	Nov. 4	8.05
" 30	8.05	" 12	8.05
Dec. 1 Sunday		" 19	8.05
" 2	8.05	" 26	8.05
" 3	7.05	Dec. 3	7.85

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	8.05
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date		Average week ending	
Nov. 27	26.00	Oct. 22	26.00
" 28 Holiday		" 29	26.00
" 29	26.00	Nov. 4	26.00
" 30	26.00	" 12	26.00
Dec. 1 Sunday		" 19	26.00
" 2	26.00	" 26	26.00
" 3	26.00	Dec. 3	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.69	23.50	Nov.	31.95	23.50	26.00
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Nov. 27	8.70	Oct. 22	9.08
" 28 Holiday		" 29	9.04
" 29	8.70	Nov. 4	8.96
" 30	8.65	" 12	8.91
Dec. 1 Sunday		" 19	8.62
" 2	8.65	" 26	8.61
" 3	8.65	Dec. 3	8.67

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16.01	9.41	7.29	Nov.	11.81	7.76	8.75
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

The zinc-ore market at Joplin, Missouri, is far from satisfactory, with small sales. A large surplus of concentrate is on hand. The agreed price for second-grade material was $52.27 per ton.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefore $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
Nov. 4	120.00	Nov. 19	120.00
" 12	120.00	" 26	120.00
		Dec. 3	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110.00	Nov.	79.50	102.50	120.00
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	78.82
May	49.10	63.21	100.01	Nov.	44.12	74.18	73.67
June	42.07	61.93	91 00	Dec.	42.55	85.00	....

Tin is now selling at 71 cents per pound.

ORES (New York)

Antimony: Needle antimony and antimony ore have not been quoted for some time, and it is exceedingly difficult to arrive at a price basis for either of these.

Molybdenite: There does not appear to be any new development. Works that own their mines seem to be fully occupied with the manufacture of ferro-molybdenum, but there is practically no open market for any ore or ferro to be found late in November, according to Charles Hardy.

Tungsten: Interests identified with the tungsten industry met in New York last week and appointed a committee to report on the situation. In the meantime no business is reported in ores, and it is uncertain as to just what their prices are. It seems certain that no longer can as high as $25 to $26 per unit be realized. For ferro-tungsten as high as $2.50 to $2.60 is said to have been quoted, but no business at these levels is reported.

Eastern Metal Market

New York, November 27.

The more important markets continue under regulation, with no definite information as to when they will be made open markets.

Copper is to remain under control until January 1 at least.

Tin is under international regulation, except in re-sale metal in this country.

Lead is still in the hands of the Lead Producers' Committee.

Zinc is an open market as to lower grades, and is more active and stronger.

Antimony has assumed a firmer tone.

The leading news feature in the steel trade is the announcement of plans for the formulation of an organization of independent steel companies to look after export trade. So far, 28 companies, representing an ingot production of 20,000,000 tons per year, have given informal approval of the project, and a New York charter will soon be secured for the Independent Steel Products Corporation. This will take in a large part of the capacity outside of the U. S. Steel Corporation which has its own export sales unit. The companies represented propose to devote 10% of their output to export trade, regardless of fluctuations in domestic demand. New inquiry, and particularly that of an export nature, has given a new turn to steel trade sentiment in the last week, after two weeks of cancellations. As to prices for export trade, there is no definite level yet, except that for such transactions as have been reported, higher than fixed domestic prices have been realized or quoted. The Steel Section of the War Industries Board has notified all manufacturers that it would discontinue allocations of steel on November 30.

LEAD

There is no change in this metal, which continues under the control of the Lead Producers' Committee, with all distribution of orders regulated by it at the fixed prices of 7.75c., St. Louis, or 8.05c., New York. One dealer in lead expressed a personal opinion today to the effect that probably this metal would be the first to be released from control because the regulation of the market is voluntary. This, however, is not likely to happen until supplies are larger than at present. Lead made from foreign ores is being offered at 7c., New York, in bond.

COPPER

The entire future of the copper market rests on the question as to its control. The only definite factor is that prices have been regulated until January 1, and that a meeting has been arranged between producers and Government officials for about the middle of December to determine the future policy. It is difficult to get a line on actual conditions, the entire situation being still under the close control of the Copper Producers' Committee. Little is heard of any cancellations—foreign or domestic—and their advent does not seem to be as much of a factor as in the steel market. Considerable has been heard, particularly in the stock market, of sales of copper under the fixed prices. It turns out that any such sales have been of casting copper only, some of which has gone as low as 24.50c. per lb. This is not a new happening, though the price is a low one. It is understood that no re-sale of electrolytic or Lake copper is permissible under the regulations. The principal news feature of interest has been the reported formation of a combination of American producers and sellers to control sales for export. Details are not available, but the truth of the report is indirectly acknowledged. It was brought about partly by the reported organization of foreign governments to arrange purchases in this country and to protect themselves. An interesting speculation has been brought up as to what may happen to copper held by manufacturers for Government account. Little is heard of new domestic inquiry, but it is stated that the Anaconda company has just closed a contract to furnish the British government with 1,200,000 lb. of ½-in. copper rods delivered at British ports.

TIN

The market is virtually a controlled one, all future shipment buying being done by the U. S. Steel Products Co. There are many interesting situations developing as a result of this, and it may be possible to say more about it later. A talk today with a large importer opened many interesting possibilitiees. Suffice it to say that the impression is growing that a huge mistake has been made in international control of the market, particularly as it came at a time when it was not necessary. It is evident that stocks in consumers hands are much larger than supposed, and that much of the metal now bought and allocated to this country is at high prices. The only open market is in the re-sale of such tin as consumers and dealers desire to get rid of. There has been more of this lately, enough to test the market really in a moderate way. Sales have been made from 75c. per lb., New York, a week ago, to 71c. per lb. yesterday, which is the spot quotation, principally for Straits and Banca tin. Arrivals of tin at Pacific ports so far in November have been 1975 tons, with only 100 tons at Atlantic ports. On Monday the 25th the London market for future shipment was £300 per ton, or 68c. per lb. in London with exchange at $4.75½.

ZINC

The market has taken on a decidedly better tone as a result of fairly large buying both for domestic consumption and for export. The former has been for the use of galvanizers who have long been out of the market, and the movement is distinctly on a peace basis. As a result of this buying, quotations have firmed appreciably and the position of the market is regarded as strong. Prime Western for December delivery is selling at 8.20 to 8.25c., St. Louis, or 8.55 to 8.60c., New York, with prompt delivery at 8.40c., St. Louis, or 8.75c., New York. For first quarter the quotation is 8c., St. Louis, or 8.35c., New York. Producers as a rule are what may be termed shy sellers.

ANTIMONY

The peace scare is evidently over in this market, and on some demand the market has strengthened to 8.50 and 8.75c., duty paid, for wholesale lots for early delivery.

ALUMINUM

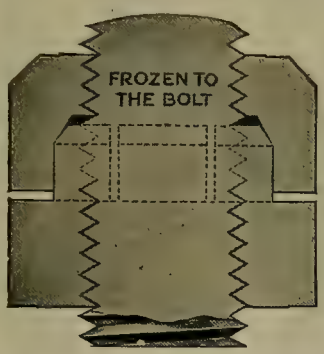
There has been no announcement of a change in the maximum Government price for No. 1 virgin metal and for scrap, which continues at 33c. per lb. for 50-ton lots; 33.10c. per lb. for 15 to 50-ton lots, and 33.20c. per lb. for 1 to 15-ton lots.

Manganese alloys: Re-sale lots of spiegeleisen are appearing, but so far no transactions are reported. The conditions are such that these could be parted with at a concession under the present quotation of $70, furnace. Sales of only small lots of ferro-manganese are reported at $250, delivered, for 70% alloy. Demand for both alloys is light.

INFORMATION FURNISHED BY MANUFACTURERS

THE DRAKE LOCK-NUT

The Drake lock-nut was devised and patented by George F. Drake of San Francisco. He states that it was his idea to develop a device in a lock-nut that would securely lock on the bolt, at the same time be a simple and correct mechanical job, and one that could be manufactured at a consistent price. The first illustration is a scale drawing of a 1-in. U. S. Standard. The lower, or nut-member, has an ample wrench-hold to turn up the nut and pull the work into place, giving it a micrometer adjustment. After this, the upper or locking-member is turned down, and the contact occurring only on the 25° angle at the top of the boss, which is made flexible by slotting, the lower member is



securely locked on the bolt at the point of adjustment first obtained without lifting the load off the lower member onto the upper member. This is explained by the fact that the two members never contact or seat on a horizontal line at the bottom or top of the boss. The seat or contact occurs on the annular bevel at the top of the boss and the interior annular bevel in the upper member, which is situated at the 'centre of the mass' and point of greatest strength of the upper member. This bevel being 25°, and 20° in larger sizes, has a much greater element of shrink than of lift, thus locking the flexible finger members of the lower member on the bolt without lifting the load already hanging there.

The second illustration shows that the device makes a complete finished job, for the corners of the 'hex' can easily be matched up in locking. The total height of the Drake lock-nut equals a standard nut and check-nut, and they are made in ¾ to 1-in. sizes (Society of Automatic Engineers) and ¾ to 2-in. United States standard.

The Drake lock-nut is manufactured by the Drake Lock-Nut Co., Folsom and Tenth streets, San Francisco.

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One of the most frequent causes of generator shut-downs has been, and probably will be, failure of the armature insulation. By a happy choice, Westinghouse Electric & Mfg. Co.'s engineers early decided on mica, a material that does not age, is unaffected by temperatures far higher than those in the modern well-ventilated generator, and remains unimpaired under the static discharges common to all high-voltage machines. Efforts have been directed for many years to the perfection of their methods in the application of this material as armature coil insulation. Proof that this early choice was a most logical one is found in the increasing use of this material by all manufacturers of electric machinery building large capacity and high-speed machines.

The danger of runaway speeds, 50 to 100% above normal, is ever present in the hydro-electric plant, and a rotor construction that safely withstands the stresses incidental to this abnormal condition, is essential. No single type of construction will cover, with safety and economy, all the range of capacity and speed encountered. Cast-iron is satisfactory only for low-peripheral speed rotors; steel castings, if of large size, may not be sufficiently uniform in strength to rely on; laminated-steel rims and rolled-steel plates are sometimes resorted to for high-speed service.

COMMERCIAL PARAGRAPHS

The Detroit Graphite Co. has a service flag indicating that twenty of its employees are in the Army, save one in the merchant marine. Bulletin No. 1, which contains copies of letters sent from the front, has been published.

Following a recent meeting of the directors of **Fairbanks, Morse & Co.**, of Chicago, C. H. Morse, Jr., the president, announces several new and important changes covering the active management of the business: R. H. Morse has been elected vice-president in general charge of purchasing and traffic. His connection with the firm covers many years of varied experience in both sales and manufacturing departments, and he continues his duties as a director. C. W. Pank rises from general director of sales to vice-president in charge of sales of all factory products. W. S. Hovey, formerly general manager of the firm's large manufacturing plant at Beloit, Wisconsin, has been elected vice-president in charge of general manufacturing at all factories. W. E. Miller becomes vice-president and treasurer instead of first vice-president. F. M. Boughey retires from the position of treasurer to become secretary and comptroller.

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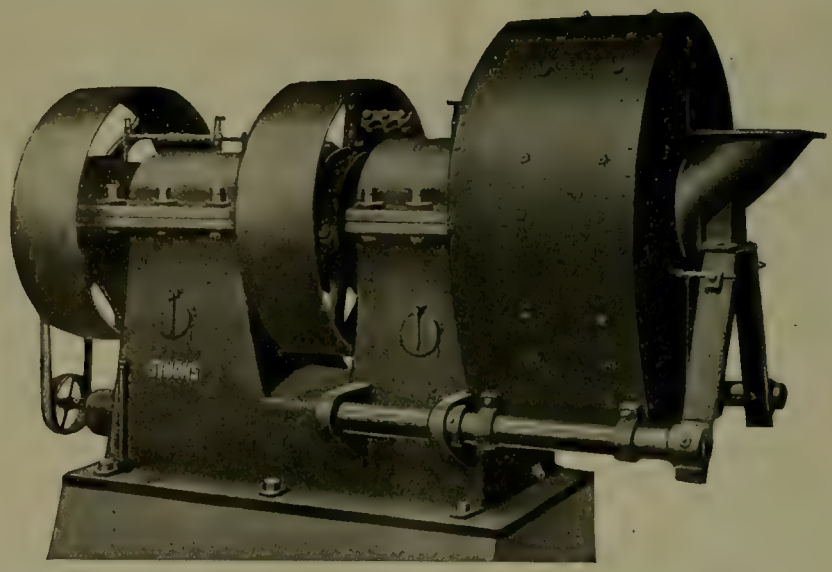

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Edited by T. A. RICKARD

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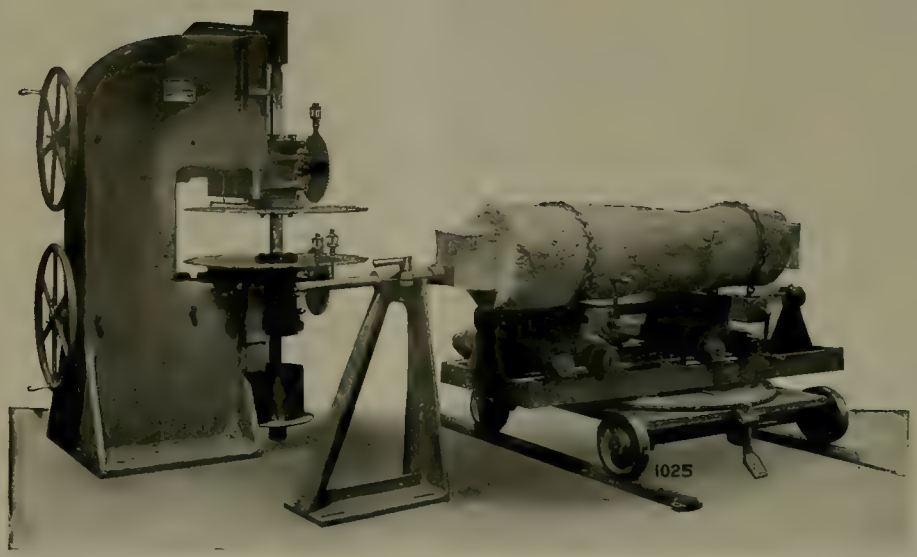

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EDITORIAL STAFF

T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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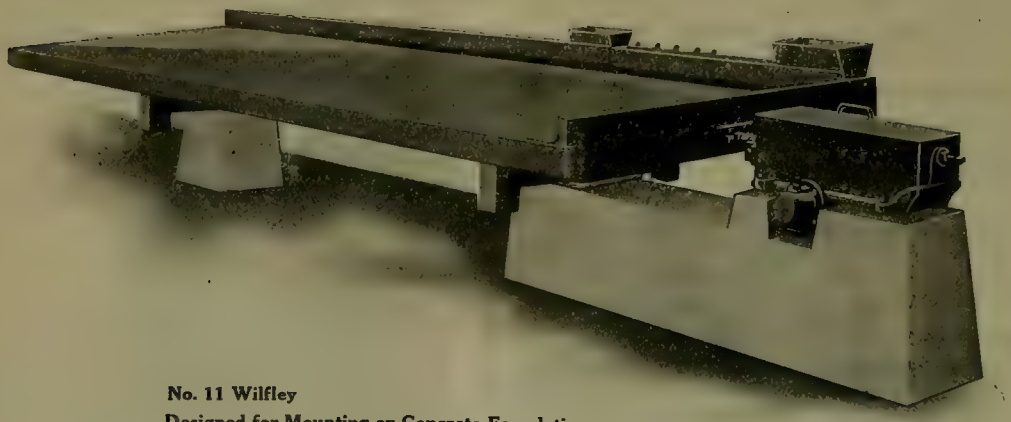

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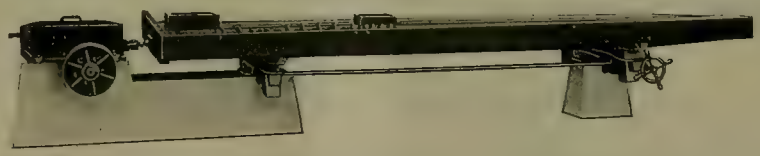

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EDITORIAL

WE publish a circular issued by the American Mining Congress on the chrome-manganese scandal and on another page we print an important article on the subject written, at Washington, by Mr. Courtenay De Kalb.

GOLD and its status in the world of business continues to be a timely subject. The great process of rehabilitating industry and restoring international commerce will be influenced profoundly by any change in the appreciation of the standard metal. This being so, our readers will be glad to have the eminently sane and thoughtful article by Mr. Blamey Stevens, who brings to economics the common sense and scientific study that have marked his incursions into mining geology.

AMONG the great men at the Peace Conference the most interesting is Clemenceau. Of the deputies in the National Assembly of France that signed the solemn protest against the cession of Alsace-Lorraine on February 18, 1871, he is the only survivor. At the age of 78 he has lived not only to see his fondest hope realized but he has the proud satisfaction of having been Premier in the Cabinet that led the French people to complete vindication of the wrong done by the Prussian 47 years ago. His sobriquet of 'the Tiger' and the name of his paper 'L'Homme Libre' serve to suggest alike his tenacity as a politician and his liberalism as a man. To no man of this generation has it been given so completely to crown his career by the accomplishment of a noble purpose.

ENGLISH, it is reported, is likely to be the language of the forthcoming conference at Versailles. This is due in part to the inability to speak French of several of the principal representatives and in part to the fact that the representatives of France can speak English. The great Clemenceau was teacher in a young ladies seminary in Connecticut for four years and married an American girl, so that he speaks not only English, but American. Mr. Lloyd George speaks some French but not enough for the delicate shades of meaning involved in the making of a treaty of peace. Mr. Wilson does not speak French. Signor Orlando speaks English. Mr. Balfour speaks French fluently. Of the American representatives, only Mr. White is at home in the language of diplomacy. The reasons for conducting the negotiations in English are obvious. If our language is adopted for this momentous occasion it may be regarded as a tribute to the influence of the English-speaking countries in the national council, but it will be also an evidence of the lack of linguistic ability characterizing most Americans and many Englishmen as compared with the statesmen of continental Europe.

AT the close of the year the War Industries Board will cease to exist. It is announced that Mr. Bernard M. Baruch has tendered his resignation as chairman of the Board. We have not been predisposed to admire Mr. Baruch's activities at Washington because we do not like to see men of his type—that of brokers, speculators, and promoters—placed in the position of regulating competitive forms of industry, but it must be conceded that Mr. Baruch has risen superior to his previous training and proved himself both a conscientious and a capable administrator. Now that the War Industries Board ceases to exist, it will devolve upon the Bureau of Mines to perform such of its functions as survive the cessation of war. The Bureau will have a good opportunity to prove itself the best friend that mining has at Washington.

ON December 3 the indictments against those responsible for the deportation of the I. W. W. at Bisbee in July 1917 were quashed by Judge William W. Morrow in the U. S. District Court at Tucson. The indictments had been returned against 25 men many of whom were prominently and honorably connected with mining operations in the Warren district. The deportation expressed the bitter feeling aroused against the anarchistic phase of the labor movement and followed the strike of copper miners that had threatened the safety of life and property at Bisbee. At the time we expressed regret that men known to us as good citizens should have taken the law into their own hands and adopted measures so destructive to the welfare of democratic government. Their excuse is that the Federal government, despite an appeal from the Governor of the State, did not send troops to quiet the disorder and no other military force existed for the purpose at that time because all the State troops had been mustered into the Federal service. The trouble was fomented by the I. W. W., assisted by Austrians and Mexicans, who resorted to intimidation and violence against the men, Americans and other

orderly elements, that continued at work. Thus, it is argued by the mine operators and engineers, the deportation became a regrettable necessity. On the whole we are glad that the incident is closed, but we hope that it will be regarded, not as a precedent, but as a lapse from the code that should govern those loyal to the principles of law in a free commonwealth.

CAMOUFLAGE gained fresh significance when Hearst printed the British flag on his papers last Saturday, which was the day set aside for celebrating Great Britain's part in the War. On the same day newspapers all over the country were publishing excerpts from the evidence offered by the Department of Justice to the Senate committee investigating the relations between the brewers and German propaganda. The evidence included a dispatch sent by Von Bernstorff on June 2, 1916, to the German Foreign Office, in which he said that the "Hearst organs have, during the course of the war, always placed themselves outspokenly on our side." The German ambassador also said that "Hearst is not aware that Hale is our agent, but knows him only as a Germanophile journalist who has contributed leading articles to papers." The 'only' is eloquent. Mr. Hearst should not fly other peoples' flags but use the one that he serves.

BRISBANE, under his contract with Hearst, writes what he pleases and Hearst publishes it "if he wants to," so said Mr. Arthur Brisbane himself to a committee of investigation at Washington. He 'pleases' to write some pitiful drivel occasionally, as, for example, recently in 'The Examiner' on the subject of molybdenite. This, Mr. Brisbane says, is "the new precious metal . . . It is found on high peaks, sometimes thickly crowded with the metal . . . Thousands are digging in the snow . . . The new metal that has caused an excitement like the gold fever is used to harden the rifling inside of [sic] cannon. The prospectors apparently believe [with Hearst] that rifled cannon shall be needed [against England and Japan?], and they are probably right [the gospel according to Hearst]. Molybdenite is the necessary brother of gold, the other precious metal [sophomore high-school!]. As long as men hunt for gold they will want molybdenite to rifle the cannon to protect their gold." This precious nonsense is foisted on an untechnical world with all the glitter of irresponsible journalism. From it one can infer how safe Mr. Brisbane is as an educator of the people à la mode de Hearst.

OUR friend 'The Mining Magazine', in London, has gone through the period of the War with success and credit, thanks to the energy and business acumen of Mr. W. F. White and the good editorship of Mr. Edward Walker. We note, in the November issue, apropos of the passing of Henry R. Merton & Company, an editorial expression of regret at "this abuse on the part of the public of German or Anglo-German metal firms and the wild talk about strangling by the insidious octopus. Everybody in the metal trade knows perfectly well that the Australian metal output was lost to England because German buyers gave better prices and prompter cash, and because they financed mines for the sake of the metal output and not with the object of creating a gamble on the Stock Exchange." We do not share this view, but we give it because it is interesting. Some of the assets of Henry R. Merton & Company are being taken over by the Central Mining & Investment Corporation, identified with Wernher, Beit & Company.

GOOD LUCK to the President on his journey to Europe! Whatever the political color of our citizens, all must unite in wishing him success in the great work he has in hand as the spokesman of the United States. Meanwhile the press of this country needs to summon all its resources of moral earnestness in the effort to lead public opinion to a consistent support of the high principles that should guide the peace conference. The President will suffer less from the scurrilous attacks made upon him by such political opponents as Mr. Roosevelt and Senator Sherman than from the mawkish adulation of certain democratic newspapers. For instance, the description of the President at work on board ship preparing a speech that is to "mark a milestone in the history of mankind." Such flattery makes it hard for the man that is to deliver the speech. Likewise the description of the President as "the world's deliverer"; that is an exaggeration that only throws ridicule on the splendid work he has done and is going to do. Let us give him, not unreasoning adulation, but united support.

BEFORE the War the name of Zabern was eloquent of Prussian tyranny in Alsace-Lorraine. Zabern is a little town on the border of the two restored provinces. In November 1913 it engaged the sympathetic interest of the world because it was the scene of several intolerable acts of brutality by German militarists. A lieutenant, named von Forstner, struck with his sword a lame cobbler who was slow in getting out of his way on the street. When the people of the town protested the colonel of the regiment, von Reuter, declared martial law and the little town was terrorized by the German garrison. A court martial acquitted the two principal offenders and the Crown Prince sent his personal congratulations to von Forstner. What is the sequel? Forstner was killed by his own men in the early days of the War; Reuter fell in battle during the first invasion of northern France; the regiment that terrorized the good people of Zabern was annihilated; the lame cobbler has lived to welcome the entry of French troops into the town; the Crown Prince is in a hamlet on the Zuyder Zee and is talking nonsense to irresponsible reporters; Alsace-Lorraine is a part of France.

SUNDRY cheerful analogies have been drawn between 1865 and 1918, the expansion of industry after the Civil War being taken as a hint of similar good times after the greatest of all wars. No industrial prostration followed the conflict between the North and South, on

the contrary the sequel was a prompt return of prosperity and a remarkable increase in railroad building, which stimulated business of every kind, including mining. The Western States, notably those of the Pacific Coast, underwent intensive exploration at the hands of former soldiers and new immigrants. The analogy will scarcely hold today, because the West has been over-run by prospectors during the interval between the two wars cited and the search for certain minerals was particularly intensified during the four years of the European war. Nevertheless the demand for metals will be a favorable factor to renewed search and the resumption of railroad construction may facilitate mining operations in districts now handicapped by lack of cheap transportation. If the analogy be pursued, it may be anticipated that the zest of the American explorer will reach forth into neighboring lands, notably Canada and Mexico.

Captain De Lamar

The death of Joseph R. De Lamar robs the mining world of one of its most notable personalities. Capt. De Lamar's career was romantic, for he ran away to sea from Amsterdam when a boy and became master of a ship trading between the Bermudas and New York. In 1878 the lure of the Leadville boom brought him to the West, where eventually he became one of the most active and successful of mining adventurers. He made money out of mines in Idaho, Utah, and Nevada, becoming a millionaire. Then he went to New York and continued to be successful in mining operations in Canada, notably the Sudbury nickel district and the Cobalt silver district. Recently he financed a large beet-sugar refinery in Utah. He died at 75, after having hit most of the high spots accessible to a man of his type. He worked hard and spent his money judiciously. He was discriminating in his choice of mines, avoiding those offering a narrow margin of profit. Where others were eager to secure possession of mining property, he bided his time. He had a commercial instinct alike in buying mines and in purchasing pictures. Although not averse from the chicane of a tricky business, he did not peddle stocks or promote companies as a means of unloading disappointing mines on the public; on the contrary, he dealt with others in 'the game' well able to protect themselves. Thus it became a contest of wits, in which he took an even chance. The Nipissing fiasco will be recalled as an example of his outwitting clever people, for in that affair he euchred the Guggenheims and their expert to a laughable degree. He was keen in keeping well-informed. For instance, he would read scores of local papers in order to get news of the latest discoveries in the West, and he was, we are told, a diligent reader of the Mining and Scientific Press. He was always ready to send a 'scout', one of his staff, to investigate any new find of ore. He was willing to face the risks of mining, and to depart from the beaten track. Thus, he erected a notable metallurgical plant at Mercur, introducing an early use of steel-concrete construction; and at Bully Hill he built an up-to-date copper plant, to which, when he found trouble in marketing his blister copper, he added his own refinery. He was a 'live' man, no mere cog in the machinery of life, but a driving-wheel. His code was not that of the Sunday-school but of the business arena, yet he lived up to his own code and made himself useful in his day and generation.

The Mooney Case

The fate of two bad men is engaging the attention of the public: William Hohenzollern and Thomas Mooney. It should cheapen the ex-kaiser in his own estimation to know that the question of his punishment divides interest with that of a social outlaw of the lowest type. On February 9, 1917, Mooney was found guilty of complicity in the outrage whereby ten persons—men, women, and children—were killed and fifty were wounded by the bursting of a bomb during the Preparedness Parade in San Francisco on July 22, 1916. A few weeks after Mooney had been sentenced, the principal witness for the prosecution, F. C. Oxman, was discredited by the publication of letters indicating that he had attempted to suborn another witness, F. E. Rigall, to commit perjury. Although Oxman was acquitted of the charge, his own testimony became suspect. That of several other witnesses suffered in later proceedings before the same Court against other defendants arraigned for the same crime. The Mooney case became the subject of public controversy, thanks to propaganda attempting to link his name with the labor movement and the taking of sides by the newspapers of San Francisco. The notoriety given to the case, in this country and abroad, induced President Wilson to appoint a commission of inquiry, headed by Mr. Felix Frankfurter, of the War Department, and assisted, among others, by Mr. W. B. Wilson, the Secretary of Labor. This commission issued its report on January 26, 1918, unanimously recommending a new trial, while refraining from expressing any opinion as to Mooney's guilt. In this report mention is made of "an attitude of passion stimulated by all the arts of modern journalism," the reference being to the shameless efforts of a San Francisco paper to exploit the affair by all the tricks of irresponsible sensationalism. On March 1, 1918, the Supreme Court of California affirmed the judgment of the lower court, denying a new trial. On July 27 the Governor of California, Mr. William D. Stephens, reprieved Mooney pending an appeal to the Supreme Court of the United States, which, on November 18, refused to review the case. On November 28 the Governor commuted the sentence of death to imprisonment for life on account of new evidence not in the trial record. In doing so, he made public two telegrams from the President, dated March 27 and June 4, this year, in both of which a request was made to commute the sentence on the ground of international sentiment. It is, of course, most unusual for the President of the United States to interfere in the administration of justice in a State, but the circumstances were unusual. Owing to the partisan

feeling aroused among the labor-unions the fate of Mooney had become an issue as between labor and capital. This phase of the affair had been purposely exaggerated by his supporters, so that it had been made to appear to the Socialists and Labor elements in Russia, for example, and also in England and France, that Mooney was the victim of a miscarriage of justice contrived by the plutocracy of San Francisco. In consequence of the success of world-wide propaganda in arousing class prejudice, the Mooney case had become a test of democratic institutions. At this time President Wilson was standing before the world as the spokesman of democracy and as the proponent of the humanitarian spirit evoked by the horrors of war, therefore it was awkward for him to be subjected to the jibes of Russian agitators, who had left the United States to foment Bolshevism, when they pointed at Mooney as the victim of capitalistic tyranny. Hence his anxiety to quiet the scandal, if possible. It is a scandal, of course; it exposes a defective judicial system, vitiated at its source by reason of popular election to office of those charged with the enforcement of law; it is another example of the injury done to a democratic commonwealth by the feud between the activities of the predatory phases of labor and capital in an industrial community. Mooney's real name is not known definitely, his mother is Irish, his wife is an Austrian Jewess, and there is reason to believe that Mooney himself is a Russian Jew on his father's side; nominally he is an iron moulder; actually he is a member of half a dozen anarchistic organizations, including the I. W. W. and the Allgemeiner Arbeiter-Bildungs-Verein; he was secretary of the International Workers' Defense League, an I. W. W. organization; on July 14, 1916, he incited a strike against the United Railroads, a company controlling one of the street-car systems of San Francisco; on that day he led a wild attempt to seize the street-cars by force. This connects Mooney with the long-drawn vendetta between the United Railroads and the labor-unions. At the head of the Preparedness Parade rode Mr. Thornwell Mullally, chief assistant to the president of the United Railroads. The unions looked upon the parade as an open-shop demonstration. Only twelve days previously the San Francisco Chamber of Commerce had called a meeting "to stamp out the disease" of unionism, and a million dollars had been subscribed to prevent the unions from throttling industry in this city. Immediately after the bomb outrage, Martin Swanson, a detective in the employ of the United Railroads and Pacific Gas & Electric companies, took charge of the investigation, gathering the bulk of the testimony against Mooney. The capitalistic class seized on the case as a chance to fasten discredit upon the cause of labor. The District Attorney, Charles M. Fickert, who prosecuted Mooney, was considered by the labor party, and by others less prejudiced, to be the tool of the public service corporations of San Francisco, and his conduct in office has indicated subservience to sinister influences. Thus the Mooney case appears as a sequel to the Schmitz-Ruef scandals that rocked San Francisco after the earthquake-fire in 1906. It is true, the reform movement of those days dealt with the corruption of City officials by the public service corporations, but the supervisors had been elected on a Labor ticket and most of them were union men. Then corrupt labor had conspired with corrupt capitalism; now they were at war over the Mooney case. This view of the affair is confirmed by the report of J. B. Densmore, published on November 22. Mr. Densmore is described as director general of the U. S. Employment Service, an annex of the Department of Labor. The report contained a dictagraph record of telephone conversations in the office of the District Attorney and constituted a lurid revelation of the illicit relations between the law and the tenderloin, between the police courts and the underworld. In this report it is stated that "there is nothing about the cases [of Mooney and others] to produce a feeling of confidence that the dignity and majesty of the law have been upheld." To speak of either 'dignity' or 'majesty' in connection with Mr. Fickert and his antics is a satire, but the same may be said of Mr. Densmore and his report, which is flagrantly unfair and bitterly partisan; it reads as if prepared for the purpose of discrediting everybody connected with the prosecution of Mooney. It throws little light on the case itself. Not the least remarkable feature of this investigation into Mr. Fickert's activities is the fact that it emanates not from the Department of Justice but from the Department of Labor. It looks like an official effort to suggest that the cause of labor is involved in the fate of Mooney, although the President's commission of inquiry had stated that Mooney "has not been identified with the labor movement" but "with a small group of agitators of pronounced anarchistic tendencies." Thus the issue has been further beclouded. Evidently at the present time not Mooney but the District Attorney and the Courts of Justice are on trial, and this regrettable result is not mitigated by the fact that Mooney is known to be a vicious anarchist. It has been said by utterly irresponsible people, that "he ought to be hanged whether guilty or not." To say so is to slap justice in the face and to make a stab at the heart of Democracy. Mooney was under trial for a particular crime; if not guilty of it he should be set free, no matter how black his previous record. On the whole, we would say that, recognizing the doubt of Mooney's guilt that has been created in the minds of men throughout the world, the Governor was wise in commuting the sentence; it were better for ten guilty men to escape punishment than for confidence in the courts of law to be undermined. One word more: on the spot where the bomb was thrown there has been built a twelve-story office-building for the Southern Pacific Railway company; this handsome building covers the area of a block, yet it has been occupied for a year; in other words, a great crime has gone unexpiated for a period more than twice as long as the time required to erect a magnificent building on the spot where the crime was committed. Is it better to build rapidly or to do justice swiftly? What is all our material advancement worth if the law is disgraced and democracy dishonored?

The Government and the Miners

By COURTENAY DE KALB

No more sudden *volte face* could be imagined than that which the Government has made within the last two weeks. It affects the metal industries profoundly. As for the manufacturing enterprises of the country, it may be said that they are absolutely at sea. It is a marvelous example of the inherent good sense of the people that a financial panic has not occurred. The stability of the market, for in fact it has been remarkably firm in view of what has happened, may prove to be due to the powerful influence of a few patriotic men who are in a position to control the industrial and stock operations of the country. Without some such stabilizing influence it is inconceivable that a collapse should not have followed the Presidential message, in which he told the business men of the country to look out for themselves, as the Government had no intention of sustaining industry during its transition from a condition of war to one of peace. The President was highly complimentary toward the business men, as he had good cause to be, and he expressed his admiration over the rapidity with which "the process of return to a peace footing has moved in the three weeks since the fighting stopped." He added that "It promises to outrun any inquiry that may be instituted and any aid that may be offered. It will not be easy to direct it any better than it will direct itself. The American business man is of quick initiative." This is very pretty, and it is also not without a touch of humor. Immediately after the signing of the armistice the heads of the War Boards told the country of the plan of the benevolent Government to sustain all industry by a continuance of the policy of price-fixing, by cancelling contracts slowly in order that neither the manufacturers nor the laborers should suffer, by letting down gradually from the high-pressure of war for the purpose of giving the steel and other great industries an opportunity to survey the industrial field and to book orders at home and abroad. It was said that six months at least would be required to effect the transition safely, and during that period the War Industries Board in particular was to be converted into an industrial clearing-house. Instead of that the War Industries Board, Mr. Bernard M. Baruch, his heads of sub-committees, including the notable person who has been running the Ferro-Alloys sub-committee so industriously in the interest of certain consumers of chrome and manganese, are clearing out altogether. The big barn in which the War Industries Board has been housed will be empty and silent after the middle of this month. The steel-makers who were hoping for fixed prices until July have been disappointed. Some of them are threatening to boost the prices, perhaps by way of retaliation upon Mr. John Skelton Williams, who has refused so far to make out a statement of his requirements in steel rails and rolling-stock for the national railways. As the watch-dog of the Treasury he refuses to waste the people's money; he must have high authority for paying large prices for the supplies that he contracts as the purchasing agent for the Railroad Administration. When he believes that the steel companies are making more than $20 per ton on rails at the present time he feels it to be his duty to wait until the steel manufacturers indicate greater humility by a reduction of prices. The steel men, on the other hand, declare that they are not making much profit at the prevailing prices, and that in some cases they actually would lose money by accepting orders at the old fixed price. The net result was to plunge the business world into gloom until the President addressed Congress on December 2. Then the sun came out. The President called the business men good fellows and advised them to go home and grow fat and happy by their own "quick initiative." As regards other points, of a political nature, the President has successfully used language to conceal thought, but in regard to business the message was definite and absolute. There is to be no industrial clearing-house. Whether a moral responsibility existed with regard to sustaining business is a moot point. Wide dissatisfaction exists, and many men claim that it means destruction for their enterprises. Mr. Hugh W. Sanford, who affected to take a broad statesmanlike attitude toward these national questions, when he labored to show why the chrome miners were not entitled to Government aid, used to point to the uncountable claims from other branches of industry that would swoop upon Congress if a precedent were established by the utilization of the War Minerals Bill in their behalf. The fact is that injury has been done to many private interests, and more injury will follow during the change to a condition of peace. The 'calamity howl' is inevitable, and the claimants for damages will buzz like a swarm of bees around the Capitol for months to come. The last of it will not be heard for years. This will happen, and was certain to happen, without any reference to the use of the War Minerals Bill. That measure, in fact, has nothing to do with readjustment; it was passed by Congress for two reasons, as transpired at a meeting of interested parties in the office of Secretary Lane on November 27. The first reason, as was made clear by the Secretary, and substantiated by congressmen present, was that the consumers were thrown into a panic when they saw that an immediate shortage of shipping was created by our entry into the War. In consequence they beseiged the Government for allotment of ships to bring in certain of the minerals mentioned in the Bill. Realizing that military needs were paramount, and that allotment of ships was not possible, they urged the utmost haste to develop the

domestic resources of these minerals, which were shown by the Geological Survey to be abundant. It was because of the insistence of the consumers, who had to have these substances for filling their contracts with the Government, that the War Boards and the Interior Department sent out its petitions to the people to make haste to produce these materials. The purpose of the Bill was further demonstrated by a notable letter issued by the Shipping Board on May 4, 1918, in which the people were begged not to wait until the Government had completed its plans for their protection, but giving them assurance that such necessary protection would be accorded in time. The letter is so important that it seems advisable to reproduce it in full. This was sent out by the Committee on Mineral Imports and Exports appointed under authority of the Board.

"The shipping situation requires immediate important changes in mining and allied industries. The precise nature of these changes and the agencies and methods through which they will be accomplished are not yet formulated, but there are certain fundamental facts which should be clearly understood. The acute ship-shortage has forced a drastic cut in imports of a considerable number of minerals essential to war industries. Among the more important embargoes of these are manganese, chromite, pyrite, and graphite. Some are already in effect. Others will soon follow. Ships released in this way, or their equivalents, have gone directly into military use, and with a still greater military program planned, and probable further decrease in total ship-tonnage, for a time at least, there is little possibility of early re-instatement of ships for mineral imports. The deficiencies in supply thus caused must be made up from domestic sources. Reduction of imports has been based on careful estimates of the possibilities of domestic production. Estimates have been liberal, and there is not much danger of over-production. Every ton mined here will save a ton of material that otherwise would have to be imported. The increased use of local ores will require many changes in practice and probably also reduction of less essential uses. Those changes must be accomplished, regardless of cost or difficulties, for the alternative of bringing in supplementary supplies from abroad no longer exists. Government co-operation will be necessary along several lines. Already attention is being directed to various phases of the problem by the War Industries Board, the War Trade Board, the Shipping Board, the Department of the Interior, the Railway and Coal Administrations, and the Treasury Department. There is pending in Congress a bill to concentrate control over the mineral industries most affected by ship embargoes. While the situation is being actively followed up there is likely to be a delay of at least several months before it is well in hand. If private interests wait until every detail is settled before taking steps to meet the situation there is danger of vital damage to essential war industries. Patriotism requires that the mining and metal industries do everything reasonably possible to get projects started at once. The necessary Government co-operation may be slow and halting, and mistakes are not unlikely, but as the shipping situation allows no alternative, it is a reasonably safe assumption that the absolutely necessary things will be done in time. In view of these facts far-sighted management of the mineral industry will not base its calculations for the immediate future on the practice of last year."

The object of the War Minerals Bill is clearly revealed in this important official document. It was to make good to those who trusted their Government, and who did not wait until the details of the bill were settled. It was in effect a sort of blanket contract with any and all miners that could and would produce without waiting to play absolutely safe. It is because of such a definite engagement on the part of the Government that the Secretary of the Interior, despite the advice given against the possibility of using the Act after the armistice had been signed, has been halting and considering, and, so far as the indications of occasional utterances go, is still hoping for a clear word that may seem mandatory from the people and their spokesmen in Congress, to go ahead fearlessly and stand on the technical terms which admit of applying the measure until peace has been proclaimed officially. Nothing that Secretary Lane could do would so widen his popularity and so strengthen the Administration as the recognition of the Government's responsibilty under this Act, by putting the machinery of the Act into operation as fearlessly as Postmaster Burleson exercised his technical statutory power to take over the cables for which the President felt it necessary to apologize in his message the other day. That was for purposes the virtue of which is debatable, to say the least; the use of the Minerals Act would be to carry out the solemn engagement of the Government toward those who responded to its appeal at a moment of need. The question of moral responsibility is one that will not be passed over lightly. Secretary Baker has given evidence of his feeling in these matters by directing that legislation be initiated to provide for a large list of contractors who had made arrangements in the heat of warlike preparation for supplies by accepting offers tendered by Government officials over the telephone. In ordinary business such orders are universally held to be valid, and no house would dare to repudiate orders so placed without sacrifice of its reputation for honorable dealing. On a technical point the Comptroller of the Treasury denied his ability to recognize contracts of this kind. The Secretary has said, "I have not had an opportunity to study the Comptroller's decision, but I understand from Mr. Crowell that it is very embarrassing. I have accordingly asked Mr. Crowell to prepare a draft of appropriate legislation to present to Congress to enable us to meet our ethical obligations."

It has been proposed that the difficulties with regard to using the War Minerals Act, which some persons profess to see, might be swept aside by introducing an amendment to the Act, and an amendment has been drawn for that purpose. It was also intended to institute an investigation into the status of the chrome miners, but

no action in this direction has been taken. The cause of the delay lies in the wording of section five under the Act, which provides a sum of $500,000 to be available until June 30, 1919, "for the payment of all administrative expenses under this Act." The President some time ago ordered that $100,000 out of this special appropriation be placed to the credit of the Department of the Interior, and steps were taken at that time to use part of the fund, so provided, for investigations for the benefit of potash, arsenic, and zircon production. Whether any of the money was spent for these purposes does not appear, but the amount has not been considerable in any event. When it was proposed last week to draw upon this fund for a preliminary investigation of the chrome miners, action was halted by Mr. J. E. Spurr, on the very proper ground that such an investigation was not in reality an "administrative expense", since the Act was not being administered. An amendment introduced as an Administration measure, and then held up in committee pending an investigation, which would take months to complete, would result merely in ruining the chrome miners by delay. It would take an entirely different sort of legislation to remedy their case unless prompt action be taken, and the only way to achieve that is by the use of the War Minerals Act. Mr. Baruch reiterated, as late as December 4, that he could not see why there should be any hesitation in using that Act to relieve the war-mineral miners, and that it was clearly applicable. Indirectly the chrome miners have suffered because the Act was not turned over sooner to the Interior Department. It is freely said that Mr. Baruch contemplated holding the administration of the Act in his hands if possible. It is also declared that he urged the President to hand it over to Secretary Lane at the last moment because he would not be able to employ it for the purposes of the War Industries Board, and that (to use the rude language of the street) he 'passed the buck' to Secretary Lane. This is gossip, and the objects sought by different bureaus inevitably lead to situations that give rise to gossip. The facts seem to be that both Mr. Baruch and Mr. Lane are sincere, and that they both desire to apply the War Minerals Act for the relief of the suffering miners. Mr. Baruch's work is ending, and that makes Mr. Lane the natural legatee of the Act. He has affirmed his own sense of responsibilty in the case, and has stated that the people should not be left in a position to say that their Government had not kept faith with them. On the other side his advisers have not supported him with recommendations to employ the Act. The Bureau of Mines prepared a draft of articles of incorporation for a potash corporation under the Act, and suggested that $5,000,000 be placed to the credit of the Corporation to take care of the potash industry. This recommendation has not been acted upon by Secretary Lane, and it is evident that he would prefer not to act upon one of the minerals without taking care of all those who are as clearly entitled to protection. The shade of difference between the situation of the potash and the chrome producers is too fine to appeal to practical men. The Act requires that in the case of each mineral procedure shall be taken on the determination that there exists a present or a prospective shortage of supply. The stocks of chrome are excessive at the present time on account of importations, made largely in defiance of Government embargoes, and without license. Adherence to the rulings of the Government that was protecting the consumers would at the same time have protected the producers who went into the industry because the consumers had asked the Government to encourage domestic production. Therefore there is only a prospective shortage of the domestic supply of chrome, to which kind of shortage manifestly the Act referred. In the case of potash there is no overstocked market; the consumers are not buying the stocks in the producers' hands because they expect to be able to buy their needed supplies more cheaply from Germany. Therefore there is no prospective shortage of potash, although there would be a shortage of domestic supply if the Act were so administered as to keep out shipments from abroad. Here the argument is the same as in the matter of the chrome producers; the declaration of shortage must be made in view of a shortage of domestic supply except this Act be used for stimulative purposes. This is so plain that the Secretary of the Interior has not proceeded to carry out the recommendations of the Bureau of Mines regarding potash.

Apparently the real deterrent to immediate action for the benefit of war-minerals producers is the possibility of hostile criticism concerning the expenditures by the Administration during the War. The cry of the Republicans is that the Democrats have been recklessly wasteful, while the great anxiety of the Democrats is to curtail expenditures in every direction and give no hook on which the opposing side may hang another indictment of 'extravagance'. Politics, therefore, have much to do with the halting policy of the Administration at this moment in regard to the war minerals. All that can be said now is that the question of action under the War Minerals measure is in abeyance, and that the support of many Senators and Congressmen of both parties is growing so that the Department of the Interior may not in the end hesitate to proceed under a broad construction of the Act, to carry out its deeper purposes which were to fulfil the obligation undertaken by the War Boards and Departments when they asked the miners not to wait, but to make haste and produce, trusting in the legislation then pending to make their efforts financially safe.

TUNGSTEN ORE exported from the Federated Malay States during 1917 amounted to 761 tons. In 1916 the total was 515 tons, and in 1913 only 225 tons. The ores were 60% wolfram and 40% scheelite.

CARBON is one of the most refractory materials known. It does not melt in the presence of the highest temperatures and volatilizes only in the electric arc, which has 3500°C. approximately.

The Chrome-Manganese Scandal

The American Mining Congress, by its Secretary, Mr. J. F. Callbreath, has issued the following circular under date of November 29.

Relief for those in distress as a result of failure to make effective the War Minerals Bill before the signing of the Armistice is more problematical than ever. As a suggestion of Chairman Baruch, of the War Industries Board, the President did not issue an executive order fixing administration of the bill until pressure was brought to bear and Mr. Baruch withdrew his objections agreeing that administration should be placed in the Interior Department. When, finally, the combined influences at work secured the executive order, its delivery was delayed and authority was not received by Secretary Lane until November 19.

A preliminary conference of officials of the departments interested, with a committee of the Pacific Chrome Producers Association and the American Mining Congress, was held on the 21st and it was agreed that the chrome problems should be the basis of any line of future action. A conference was at once called for (November 27) in the office of Secretary Lane, to which were invited the chiefs of the War Industries Board, the Shipping Board, the War Trade Board, the Bureau of Mines and its divisions, also the Pacific Coast Chrome Committee, and the American Mining Congress, the Committee on Mines of both houses of Congress, and the representatives of 22 users of chrome and manganese.

At the conference there were present several officials of the Government, including Secretary Lane and Director Manning, no senators—representatives Garland of Pennsylvania and Wingo of Arkansas. Other organizations as listed were represented and three chemical corporations representing 45% of chrome consumption.

A clear statement of the case was presented. It developed that consumers have on hand a full year's supply in addition to ore in bond or at the mine. No steel companies being present and the chemical manufacturers refusing to participate in any arrangement for purchasing ore now produced or ore blocked out, Secretary Lane closed the meeting without bringing out a single constructive suggestion.

The consensus of opinion was expressed by Mr. Vance McCormick, of the War Trade Board, who said, "There is no question about the Government having assumed a moral obligation" . . . though he offered no suggestion for relief. Several cases of acute personal distress among both chrome and manganese producers who had been induced to make heavy investments through the Government's appeal, were placed before the conference.

There appears little hope for general relief under the War Minerals Bill, but Secretary Lane, and Director Manning, of the Bureau of Mines, have ordered an immediate and complete investigation of all minerals included in the bill in order that exact data may be assembled upon which to make the bill effective as to future conditions and production.

In order that there can be carefully planned and completely operative machinery for pushing relief measures: The American Mining Congress hereby calls a conference of producers of manganese, chrome, tungsten, and pyrite, in Washington, D. C., on December 16 and 17 for the purpose of acquainting the Administration with all facts, presenting and considering plans for relief legislation and organizing the campaign of education necessary to success. Concrete unquestionable proofs will be necessary to back up the movement. The rights of all producers must be protected and the industries placed on a safe future basis. The American Mining Congress will co-operate in furnishing the evidence. Every producer should join this movement, furnish us at once with business statements—or—attend the conference, either personally or by representatives. We hold out no special promise of success except that as the Administration has openly admitted moral responsibility 'team' work from this time forward will probably bring results. Telegrams and letters from all producing States indicate that the industry is ready for united action.

Costs at the Tomboy, Colorado

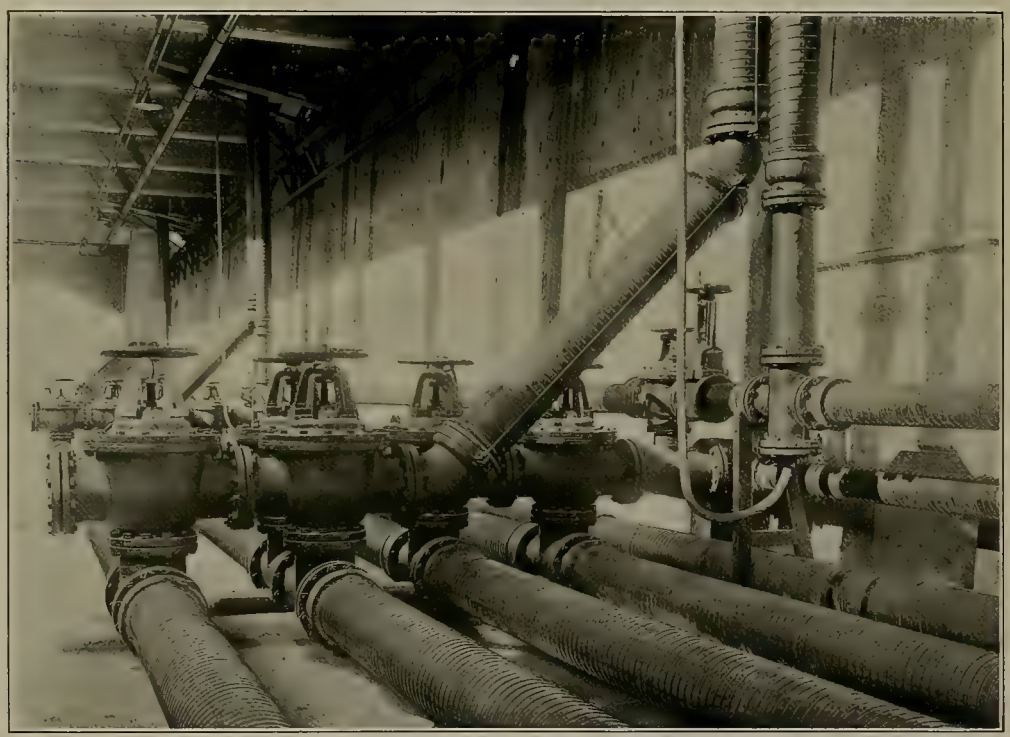
During the year ended June 30, 1918, the Tomboy Gold Mines Co., operating at Telluride in the San Juan, was handicapped by a serious shortage of labor and a marked inefficiency on the part of the labor available. The mill treated 151,028 tons of ore. Costs of all departments were as under:

Mining and development	$2.51
Milling	0.70
Concentrate expense, including transport to rail	0.63
Water-supply	0.09
Assay-office	0.05
Cyaniding	0.91
General	0.33
Taxes and insurance	0.36
Total per ton	$5.58

Gold v. Silver. Principally because of the monetary uses they serve, gold and silver are placed among metals in a separate class, and are jointly referred to as 'precious metals'. But even between them there is a great difference in 'preciousness', which is not ordinarily appreciated. The contrast in their value is illustrated in the recent shipment from the assay office to India of $3,000,000 worth of the white metal. The consignment weighed about 103 short tons, and in a solid mass had a bulk of 316 cu. ft. On the other hand, a lot of gold of equal value will tip the scales at a little under five short tons, and occupy a space of only 8½ cubic feet.

Iron ore has been reported to exist in 54 out of 58 counties in California. Of 159 different localities it is considered that 14 deposits may in time be of considerable commercial importance. All the known ores of iron are represented, the magnetic ore predominating. So far as chemical analysis has yet shown the ores compare favorably with those of any other region, some of them being of distinguished purity.

ORE-BINS, DUMP-TRACK, AND COARSE GRIZZLIES



ARRANGEMENT OF VALVES AND REDWOOD-STAVE PIPE LEADING TO LEACHING-VATS

THE LEACHING-VATS, WITH THE LOADING-BRIDGE

THE LEACHING-VATS, WITH THE LOADING AND UNLOADING BRIDGE IN THE BACKGROUND

THE PRECIPITATION DRUMS

UNLOADING-BRIDGE AT THE SOUTH END OF THE LEACHING-VATS

THE WOODEN LAUNDERS FOR PRECIPITATING COPPER UPON IRON SCRAP

THE CONCRETE LAUNDERS, SHOWING THE IRON SCRAP ON WHICH THE COPPER IS PRECIPITATED

The Utah Copper Enterprise—VIII

The Leaching Plant

By T. A. RICKARD

The ore to be leached is the oxidized cap that is stripped from above the main mass of sulphide ore. It averages 0.65% copper in the form of the carbonates, malachite and azurite, with a minute proportion of the silicate (chrysocolla), and contains an additional amount of copper, 0.1 to 0.2%, in the form of chalcopyrite and chalcocite. The principle underlying the metallurgical process is borrowed from nature, for sulphuric acid, derived from the decomposition of sulphide mineral, is used to dissolve the copper, which is then precipitated upon scrap-iron. The plant has a capacity of 2000 tons of ore per day.

The railroad-cars, containing 64 dry tons each, are discharged over grizzlies made of I-beams covered with a mushroom top of manganese-steel. Pieces of ore too large for the openings, which are nine inches wide, are broken with sledge-hammers. The ore then falls on a second set of grizzley-bars, three inches apart, the oversize going to steel bins that discharge upon steel caterpillar-apron feeders delivering to 5-ft. Stevens-Adamson pan-conveyors, by which it is discharged to screens, with one-inch openings, ahead of two gyratory crushers, No. 6 Gates, style K. From these crushers the ore passes to a belt-conveyor leading to a sizing-screen, inclined at 45°, and made of $\frac{5}{8}$-in. wire with 1-in. openings. The oversize from the screen goes to Garfield rolls, 72 by 20 in., while the undersize passes direct to a hopper discharging upon the belt-conveyor that feeds the vats. The undersize from the 3-in. grizzley passes to another sizing-screen, similar to the one already described, from which the undersize falls upon the hopper discharging upon the belt-conveyor feeding the leaching-vats, while the oversize joins the crusher product on the conveyor ahead of the primary rolls. The product from these rolls is conveyed to a screen ahead of the secondary rolls, the oversize being returned by a conveyor after passing through the secondary rolls to the screen ahead of the primary rolls, while the undersize is delivered to the vats. The belt-conveyor carrying all the crushed ore discharges upon a 4-ft. pan-conveyor provided with a transverse slot through which one part in 400 is removed as a head sample. This pan-conveyor delivers to a hopper that feeds a 42-in. rubber-belt conveyor discharging by means of a tripper traveling with a loading-bridge equipped with a Robins tripper-conveyor, discharging into and filling the leaching-vats. The product from the crushing department shows about 10% coarser than half an inch, more than 40% coarser than 3-mesh, and only 20% finer than 20-mesh. About 39% of the copper rests with the material between $\frac{1}{2}$-inch size and 4-mesh. Evidently this is the critical point in the crushing; 58% of the weight of the ore containing 48% of the copper in the ore has been separated at this stage. A typical screen-analysis is given herewith:

Screen-Analysis

Assay of tank No. 9 heading; October 2, 1918; run No. 87
Original weight 3335 grammes:

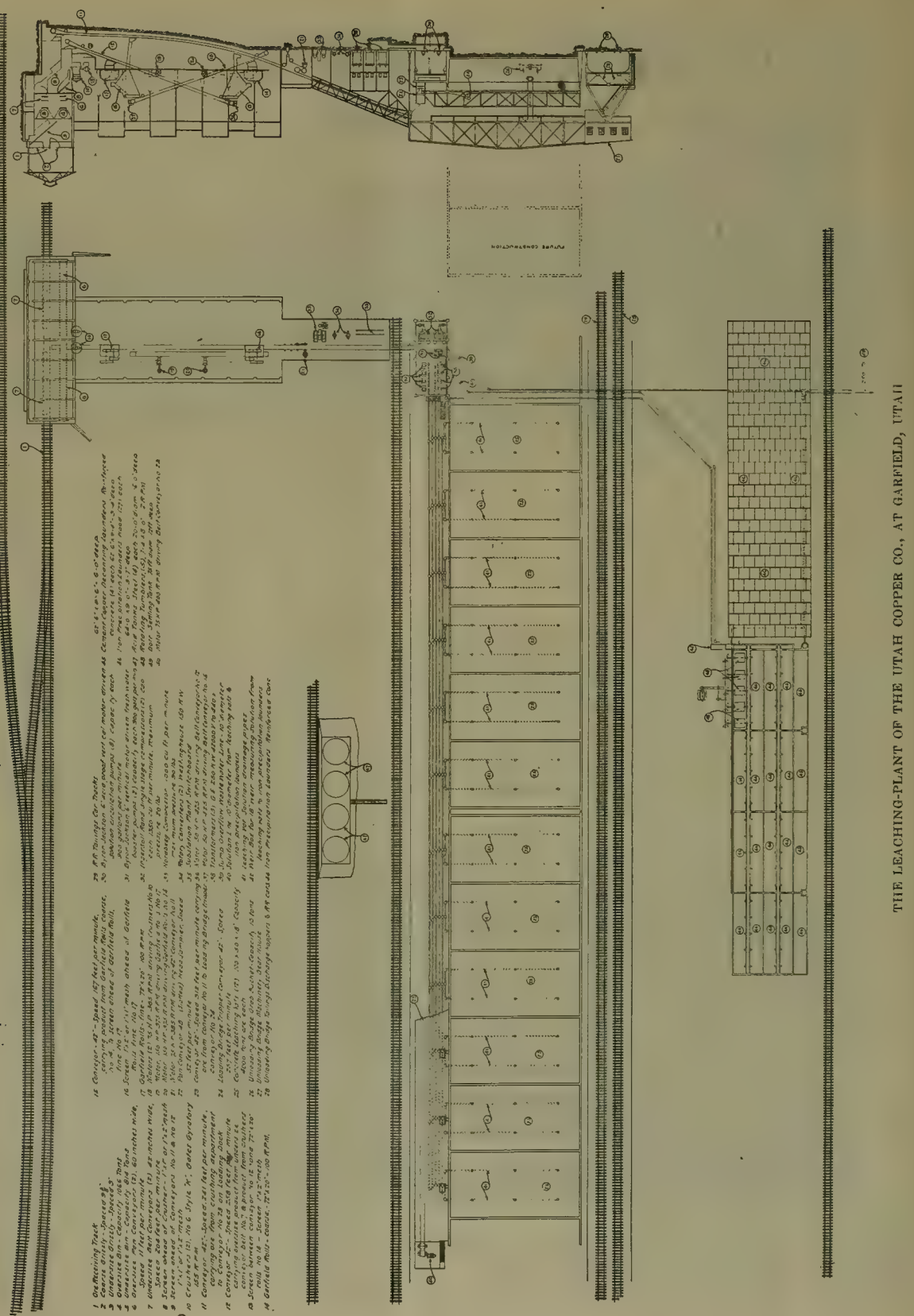
Mesh, inch	Material by weight %	Cumulative material by weight %	Copper by assay %	Weight copper %	Cumulative weight copper %
1½	0.00	....	0.71	...	....
1¼	0.00	....	...	...	....
1	0.00	....	...	...	....
¾	0.57	0.57	0.26	0.21	0.21
½	8.75	9.32	0.76	9.49	9.70
3	35.14	44.46	0.59	29.58	39.28
4	11.48	55.94	0.58	9.50	48.78
6	7.38	63.32	0.64	6.74	55.52
8	5.76	69.08	0.60	4.94	60.46
10	4.89	73.97	0.63	4.39	64.85
14	4.32	78.29	0.71	4.38	69.23
20	2.78	81.07	0.72	2.85	72.08
28	2.13	83.20	0.70	2.13	74.21
35	3.18	86.38	0.79	3.58	77.79
48	2.10	88.48	0.83	2.48	80.27
65	2.55	91.03	0.96	3.50	83.77
100	1.65	92.68	1.08	2.54	86.31
150	1.17	93.85	1.21	2.03	88.34
200	1.83	95.68	1.30	3.40	91.74
Through 200	4.32	100.00	1.34	8.26	100.00
	100.00		0.70	100.00	

The 12 leaching-vats are 100 ft. long, 50 ft. wide, and 17½ ft. deep. They are arranged in two contiguous groups of six each, so as to neutralize the expansion. They are made of concrete, heavily reinforced. The walls are lined with mastic, a mixture of

	%
Trinidad asphalt	25
Sarco putty No. 4	4
Gilsonite	4
Cement	5
Sand (minus ¼)	67

The mastic is 1½ in. thick and is reinforced with 2 by 2 by 0.162 in. diam. crimped wire. The floors of the vats are coated with mastic half an inch thick. Upon this floor come 6 by 6 in. stringers, spaced 10 in. apart, laid lengthwise of the vat. The stringers are 9 ft. 6 in. long; their ends are beveled 3 in., and they are 3 in. apart. Across them are placed wooden stringers 2 by 8 in. and $\frac{5}{16}$ in. apart. On these is spread cocoa-matting ¼ in. thick; then more 2 by 8 pieces, $\frac{5}{16}$ in. apart, so that the two-by-eights lie across each other, separated by the mat.

Ample pumping-plant capacity has been provided for the transfer of the solution as required. The intention is to resort to a cyclic advance of solution. All the valves are of the disc-and-gate type, lined with lead, whereas the pipes are made of redwood staves that have been immersed in paraffine, wound with hard-drawn copper wire. When received from the Redwood Manufacturers



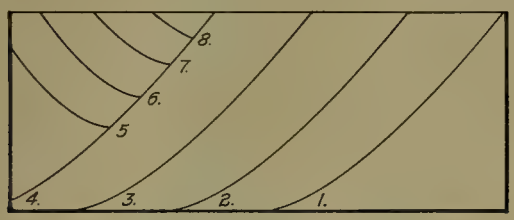
THE LEACHING-PLANT OF THE UTAH COPPER CO., AT GARFIELD, UTAH

Co. they are immersed in hot asphaltum paint. The cast-iron fittings and connections are lined with mastic. The mastic mixtures used for different purposes are as follows:

	Floors %	Walls %	Fittings %	Weight per cu. ft. lb.
Trinidad asphalt	25	25	25	89
Sarco No. 4	..	4	5	62
Sarco putty	1½	..	..	109
Gilsonite	..	4	5	63
Cement	..	5	7	83½
Sand (minus ¼)	73½	67	58	•96 †85
Pioneer paving cement	..	..	..	53½
Floor mixture	..	..	..	120
Wall mixture	..	..	..	134

•Drv. †Damp.

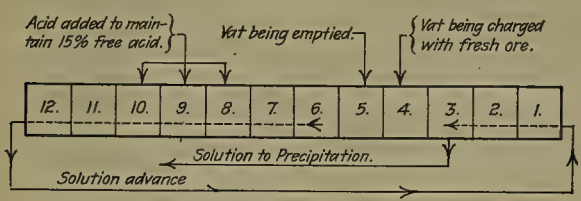
When charging, the tripper-conveyor drops the ore at one side of the vat and continues to feed on the same side until the toe of the slope reaches the opposite side; then the filling recommences from this opposite wall into the V-shaped space that has been left by the preceding operation. This is the method adopted at Chuquicamata.



METHOD OF FILLING THE TANKS

The idea is that the coarser particles of ore run to the bottom of the vat; if the filling were to advance continuously from one side, the coarse ore would extend up the opposite side, producing conditions unsuitable for the uniform percolation of the acid solution.

Fresh ore is fed into the vats in sequence, the freshest ore being subjected to the oldest solution, that is, the one containing the most copper and the least free acid. At the time of my visit, No. 5 vat was being emptied of its tailing, while No. 4 was being filled with fresh ore. The last stage of solution was taking place in No. 6, thus:



CYCLE OF LEACHING

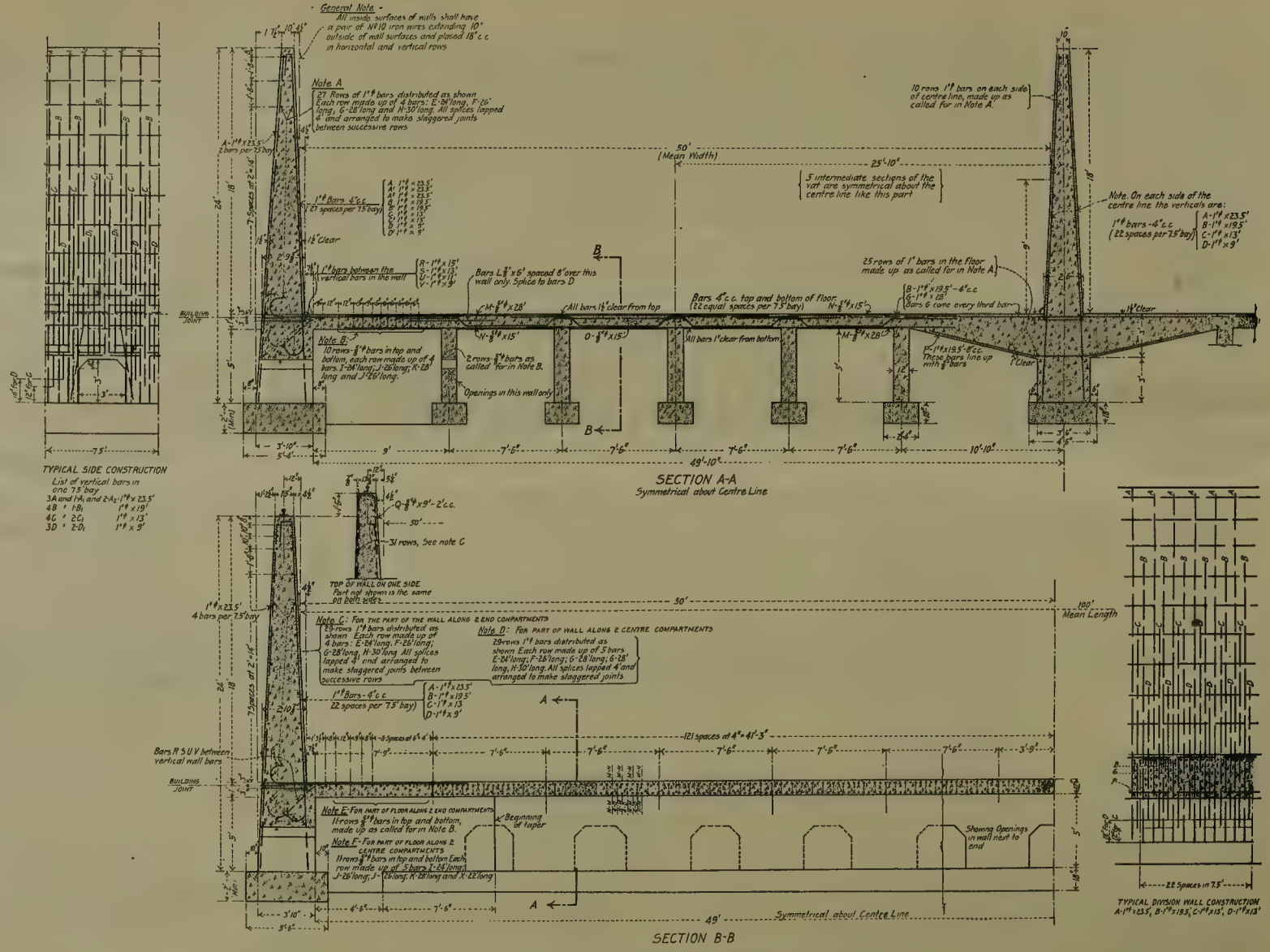
The solution is advanced at the rate of approximately 80 gallons per minute through the vats in series from 6 to 7-8-9-10-11-12-1-2-3. After all the solution in No. 6 has been advanced to No. 7, wash-water is added until the effluent from the tank contains from 0.08 to 0.15% copper. The wash-water advancing in the cycle is gradually enriched with free acid and copper, the first addition of acid having been made to a selected number of the vats, No. 8, 9, and 10, in the cycle. From this point no more acid is added, the free acid being gradually neutralized by dissolving the copper, iron, aluminum, etc., content in the ore until the solution on the newest ore, or that last charged into the leaching-vats, contains 3.16% copper, 0.37% iron as ferrous, 0.95% as ferric iron, and 0.24% free sulphuric acid. The intention is not to add acid at any stage in such measure as to cause the proportion at the close to exceed 0.2%. Thus, when the cycle of operations brings the solution to the fresh ore, the acidity is at its minimum and when the copper-bearing solution (the product of the leaching process) is drawn away from precipitation, it contains not more than 0.2% free acid. To express the idea in another way, the acidity, or strength of the active solution, is brought to a peak in the middle of the series of operations, so that when it is applied to the new ore and likewise when it is withdrawn, enriched by 2½% copper, it contains not more than 0.2% acid. The rich solution is drawn from the vat containing fresh ore, because, owing to the soluble components, it can neutralize the free acid quickest at this stage.

Ascending the stairway to the top level of the vats, I watched the solution (1.3% ferric, 0.3% ferrous iron, with 2% copper, and 2% free acid) being circulated by an air-lift after withdrawal from the bottom of the same vat, to induce circulation. The yellowish green liquor was covered with a creamy foam, except where clear patches appeared indigo-blue, owing to the reflection of a perfect sky. As one proceeds to the end of the cycle, the solution circulating in each successive vat gradually changes in color from a greenish-straw to a greenish-blue color until finally the solution circulating on the freshest (or newest) ore is of a fairly clear blue color.

The explanation of this variation in coloring is that the percentage of ferric phosphate present gradually decreases, owing to its precipitation in the ore, as the free sulphuric acid present is neutralized in the cyclic advance. The ore contains 0.2% phosphorus, which evidently first goes into solution, and is then precipitated, the greater portion being eventually discharged in the tailing. Until the presence of phosphorus was noticed, it was thought the precipitate of cement copper was contaminated with basic ferric sulphate by reason of atmospheric oxidation occurring in the scrap-iron precipitation launders. Apparently this contamination is due to the presence of basic ferric phosphate instead.

From No. 5 vat the residue (tailing), after leaching had been completed, was being removed by a Mead-Morrison excavator, which has a 10-ton grab-bucket, enabling 4000 tons to be removed in an eight-hour shift. The grab takes the tailing from the floor cleanly, planing any boards that rise above the general level. This excavator discharges into a hopper having a motor-controlled gate that empties into 45-ton Clark air-dump cars. The tailing shows only a trace of soluble copper, the greater loss being in undissolved sulphide. It would not be fair to quote the exact assay, because operations are still in the experimental stage.

Acid is obtained from the Garfield Chemical Co., five miles distant and adjoining the Garfield Smelting Co.'s (A. S. & R. Co.) plant. Fresh acid is added in the middle


General Note.
All inside surfaces of walls shall have a pair of №10 iron wires extending 10" outside of wall surfaces and placed 18" c c in horizontal and vertical rows
Note A
27 Rows of 1" bars, distributed as shown. Each row made up of 4 bars: E-24' long, F-26' long, G-28' long and H-30' long. All splices lapped 4' and arranged to make staggered joints between successive rows
10 rows 1" bars on each side of centre line, made up as called for in Note A.
50' (Mean Width)
25'-10"
5 intermediate sections of the vat are symmetrical about the centre line like this part
Note. On each side of the centre line the verticals are:
1" bars -4" c.c (22 spaces per 75' bay)
A-1" x 23.5'
B-1" x 19.5'
C-1" x 13'
D-1" x 9'
1" Bars 4" c.c (21 spaces per 75' bay)
1" bars between the vertical bars in the wall
Bars L 5/8" x 6' spaced 8" over this wall only. Splice to bars D
25 rows of 1" bars in the floor made up as called for in Note A
Bars 4" c. c. top and bottom of floor (22 equal spaces per 75' bay)
All bars 1½" clear from top
All bars 1" clear from bottom
Note B:
10 rows 5/8" bars in top and bottom, each row made up of 4 bars, I-24' long; J-26' long; K-28' long and L-26' long.
2 rows 5/8" bars as called for in Note B.
Openings in this wall only
1" Clear
BUILDING JOINT
TYPICAL SIDE CONSTRUCTION
List of vertical bars in one 7.5' bay
3A and 1A1 and 2A2 - 1" x 23.5'
4B " 1B1 1" x 19'
4C " 2C1 1" x 13'
3D " 2D1 1" x 9'
SECTION A-A
Symmetrical about Centre Line
31 rows, See note C
TOP OF WALL ON ONE SIDE. Part not shown is the same on both sides
Note C: For the part of the wall along 2 end compartments
23 rows 1" bars distributed as shown. Each row made up of 4 bars: E-24' long, F-26' long; G-28' long, H-30' long. All splices lapped 4' and arranged to make staggered joints between successive rows
Note D: For part of wall along 2 centre compartments
29 rows 1" bars distributed as shown. Each row made up of 5 bars, E-24' long; F-26' long; G-28' long; G-28' long, H-30' long. All splices lapped 4' and arranged to make staggered joints
1" Bars - 4" c.c (22 spaces per 75' bay)
A-1" x 23.5'
B-1" x 19.5'
C-1" x 13'
D-1" x 9'
Bars R S U V between vertical wall bars
Note E: For part of floor along 2 end compartments
11 rows 5/8" bars in top and bottom, made up as called for in Note B.
Note F: For part of floor along 2 centre compartments
11 rows 5/8" bars in top and bottom. Each row made up of 5 bars: I-24' long; J-26' long; K-28' long; N-28' long and X-22' long
Beginning of taper
Showing Openings in wall next to end
121 spaces at 4" = 41'-3"
100' Mean Length
Symmetrical about Centre Line
SECTION B-B
TYPICAL DIVISION WALL CONSTRUCTION
A-1" x 23.5', B-1" x 19.5', C-1" x 13', D-1" x 9'

SECTIONS SHOWING THE CONSTRUCTION OF THE LEACHING-VATS

of the leaching advance. Very little (0.06 to 0.09%) ferric sulphate passes from the precipitation vats. All of this solution is wasted. The specific gravity and assay of the solution in cycle is as follows:

	Specific gravity	Free acid %	Copper %	Iron—Ferrous %	Iron—Ferric %
To precipitation	1.1390	0.24	3.16	0.37	0.95
In centre of cycle	1.1880	1.24	2.58	0.20	0.75
At end of cycle	1.1100	1.23	1.83	0.18	0.68
Last wash-water before tailing		...	0.089	...	...

The copper-bearing solution flows through wooden-stave pipes of 10 in. diameter to the precipitation vats. The first series consists of four rows of four mastic-lined vats, each 9½ by 62½ ft. and 6 ft. deep, made of reinforced concrete, the walls being 6 to 10 in. thick, with a suitable batter. The flow of the solution continues up and down the total length of 1000 ft. In the second series likewise, the flow is continuous through 27 wooden vats, 9 by 64 ft. each, and 3 ft. 7 in. deep, a total length of 1728 feet.

In the first vat (62½ by 9½ ft.) of the first series are five barrels, 7 ft. 4 in. diam. and 8 ft. long, which are turned at the rate of two revolutions per minute. One of these is made of maple and four are made of fir. The wooden staves (4 by 8 in.) of the barrels are perforated with ⅝-in. holes placed 8 in. apart, permitting the solution to enter. The barrels are loaded with tin-cans and other small scrap-iron, which, as it becomes corroded by the solution and replaced by the copper, disintegrates. When small enough, the particles of iron, with the cement copper, escape from the barrel through the perforations into the vat. These products of the process are discharged by pulling a wooden plug in the bottom of the vat, from which the thin mud of cement copper and iron runs over a screen of ½ in. openings by which the coarser particles of undissolved iron are held. The same screen is used to clean up the residue from the other vats, and it serves to catch any leaf or plate copper that might interfere with the accurate sampling of the 'cement', or copper mud. All the vats, except the first, are filled with scrap, the heavier pieces being placed in the concrete vats and the lighter ones in the wooden vats. When cleaning up, the solution is withdrawn through a hole in the bottom, and a hose is played on the scrap so that the water removes the cement, which runs into one of the four settling-vats covered with a screen. The wash-water is decanted and the copper precipitate is removed by a clam-shell excavator into cars that transport it to the drying-vats. The decanted water flows into another vat, 75 ft. diam. and 12 ft. deep, where any remaining particles of copper settle. To this vat comes the waste solution from the entire series of vats, in order to arrest any copper that otherwise would be lost.

At the south end of the leaching-vats are three shallow wooden vats, 65 by 70 ft., full of red clay apparently. That is the cement copper undergoing atmospheric drying, or evaporation of its excess water. The method seems ill-adapted to winter or to the rainy season. The yellowish green slime of basic ferric phosphate discolors the copper. The solution coming to the precipitation vats from the leaching-vats is vividly bluish-green, the color of copper sulphate mixed with ferrous and ferric sulphates.

The precipitation plant looks like a junk-store in chemical liquidation. One regrets that the scrap cannot be macerated or otherwise reduced to small and nearly uniform particles so as to expose a large surface to corrosion and precipitation. Sponge-iron is being tried for this purpose at Ajo successfully, but the use of it depends upon the cost of production.

The accompanying photographs illustrate the various stages of the metallurgic operation.

(To be Continued)

The Elko Prince Mine, Nevada

By J. V. N. DORR and L. D. DOUGAN

*The Elko Prince mine is in the Gold Circle district, Nevada, 1½ miles from Midas, 55 miles west of Battle Mountain, and 50 miles north-east of Golconda.

The geological structure of the region is simple. The oldest exposed formation, covering most of the area, is rhyolite, which has a light-colored devitrified groundmass enclosing phenocrysts of feldspar, quartz, and magnetite. It has been somewhat weathered and partly stained with oxide of iron. There are several outcrops of andesite which cut the rhyolite. The ore deposits occur as fissure-veins, replacement veins, and sheeted zones. The Elko Prince vein is of the first type. The rhyolite near the veins is silicified, stained with oxide of iron, and, at some localities, replaced by ore, or is so permeated by metals as to be classed as ore. The vein filling consists chiefly of quartz, and the value consists entirely of gold and silver.

The following conditions influence the method of mining. The vein is almost vertical; its average width is 15 in., seldom less than 12 or more than 24 in. thick. The west wall is smooth, hard, and firm, with quartz sometimes 'frozen' to it; the east wall is less well defined, decomposition having extended into it to a depth of a few inches to two or three feet. A sliding movement has occurred in the east side of the vein, and at some points a considerable amount of gouge is found, containing pieces of vein matter. When planning a method of mining, stripping (resuing) was considered, the idea being to mine the east wall as narrow as possible, use it for filling, break the ore away from the west wall, and run it all out. The vein, however, was too brittle in many places to permit this; all of the quartz in the gouge would have been lost, as well as much of the vein proper. Stoping the ore with some waste, as little as possible, was a method that permitted the recovery of all of the ore, and it was thought that the increased milling expenses would be less than the loss by any selective method of mining. Overhead stoping was therefore adopted. The cost of mining in 1917 totaled $3.123 per ton, stoping accounting for 80.8c., timbering 55.9c., and powder 44.5c. per ton.

*Abstract from Bull. 140, A. I. M. E.

Topography and Geology of Dredging Areas—II

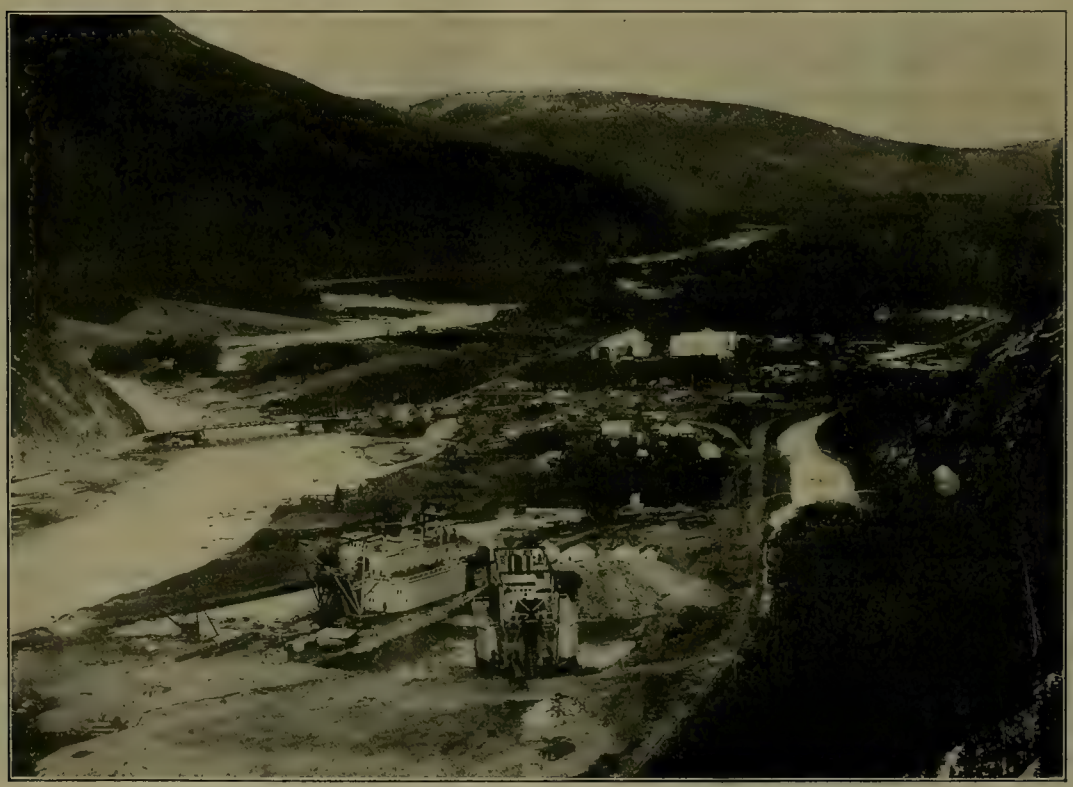
By CHARLES JANIN

*Dredging in the Yukon field, which is typical of other fields in the far North, is now being conducted on two classes of deposits: river-valley and creek-beds. Where thawed, the gravel in the valley of the Klondike river is well adapted for dredging. The gravel is free, rounded, and clean, and averages 30 to 40 ft. in depth. The bedrock is sufficiently decomposed to be dug with ease. The top burden in the thawed areas of gravel has been largely removed by stream action and presents little or no difficulty to dredging.†

The creek deposits are altogether different. They are shallow, the depths to bedrock mostly ranging about 18 to 20 ft. The gravel is angular and contains little sand, the gold is confined almost entirely to bedrock. The creek gravels are overlain with what is known locally as 'muck', a deposit containing organic matter, fine sand, and water, which is almost invariably frozen, and where undisturbed is covered with a blanket of moss. The depth of this muck is from 4 to 8 ft., averaging 6 ft. In dredging on the creeks it is necessary to take up 4 to 6 ft. of the bedrock, which is a massive and blocky sericite-schist. Operations in the Yukon district are subject to difficulties not met elsewhere except in Alaska. These difficulties are caused by the climate and the character of the deposits. The extreme cold of the Northern winter limits the open season to about six months. Dredging cannot begin until thawing has produced water enough to float the boats and to clear the ponds of winter ice, 5 to 7 ft. thick. Work at both the start and finish of the season is hindered by cold. All moving parts, such as the tailing-conveyor, must be housed and warmed with steam coils. Also steam must be used freely to keep the ladder and bucket-line clear and gold tables in proper condition. The dredging season ends when the creek freezes, so that there is not enough water for floating the boat.

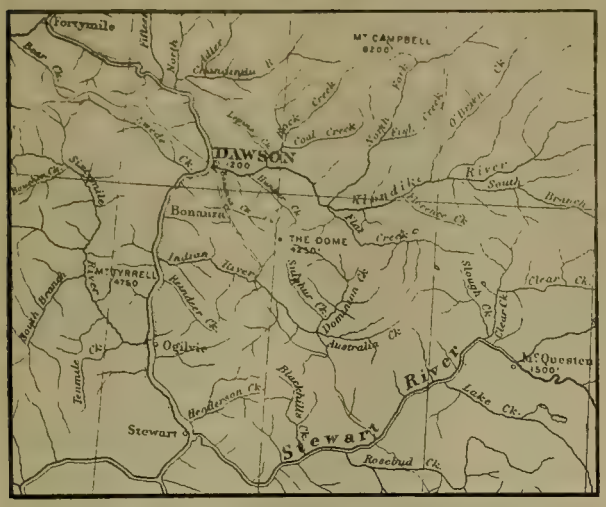
The creek deposits present many obstacles to dredging. In the first place the deposits are shallow, necessitating

*Abstract from Bulletin 127, U. S. Bureau of Mines, 1918.
†O. B. Perry, Canadian Mining Inst., Vol. 18, 1915.



DREDGES OF CANADIAN KLONDYKE MINING CO., STARTING OPERATIONS ON MAY 12, 1913

frequent moving of the dredge, both 'stepping ahead' and across the pond. Also the shallow ground increases the labor for necessary outside work, such as setting 'deadmen' and removing stumps. The thawed muck is



MAP OF THE PRODUCTIVE AREA OF THE KLONDIKE

not difficult to handle, particularly if it is sandy, but it often contains buried stumps, roots, and other material, which tend to choke the feed-hoppers and cause delays. Digging the bedrock in order to recover the gold is the most difficult part of the process. It is slow hard work which entails heavy wear on the entire machine and necessitates continual replacement of all digging parts. Frozen ground is the greatest obstacle to dredging on a large proportion of the creeks, for the gravel must be thawed before dredging can go on successfully.

The short working season led to many departures from usual methods. Effort is concentrated on getting all that is possible out of the dredges, and the result is a remarkably high efficiency for the period of operation. Each season has shown a gain in yardage per dredge-hour over the season previous, until the present rate compares favorably with that of dredges of the same size in California, where conditions are much more favorable. This result is largely made possible by thorough overhauling and repair during the months of no dredging.

The accompanying photographs show some interesting operations by one of the big companies working near Dawson, on the Klondike. The locality of the first is known as Bonanza basin. Bonanza creek may be seen at the foot of the hill on the right-hand side of the picture, and the Klondike river on the left hand, crossed by the Ogilvie bridge, and flowing along the right limit of the valley bearing its name. About a half-mile downstream the river Yukon is reached, and the town of Dawson. In the next picture the large buildings in the foreground are the shops of the Yukon Gold Co., while the Bonanza Basin camp of the C. K. M. Co. is to be seen near the lower of the two dredges.

DREDGE OF CANADIAN KLONDYKE MINING CO. ON JULY 11, 1916, SHOWING GROUND MOVED IN THREE SEASONS

Manganese in 1918

American mines now supply nearly one-third of the high-grade manganese ore needed in this country; in 1917 they only supplied one-sixth. During the first six months of 1918, shipments of ore containing over 35% Mn were 136,554 tons; while in October the rate was 28,000 tons per month, or 336,000 tons per year. Total shipments of this ore for the whole of the current year are estimated at 324,000 tons, according to D. F. Hewitt, of the U. S. Geological Survey. During the half-year, 10 to 35% ore amounted to 314,137 tons; the estimate for the full year is 832,866 tons.

The number of shippers of all grades of ore appears to have reached a maximum in the last quarter of 1917, as the number then reporting was 195; whereas the number reporting during the first six months of 1918 was only 190. The producers reporting in 1917 included many small shippers, some of whom have combined, causing an actual reduction in number, yet increasing the aggregate output of the industry.

Montana, which stood first in the production of high-grade ore in 1917, continues to lead, and its leadership appears to be secure, as the Butte district is contributing almost as much high-grade ore as the Philipsburg district, and the two together, contributing nearly all the output of Montana, now produce more than ten times as much as is being produced in any other State. Butte has 5 and Philipsburg 18 shippers. Montana is now producing 20,000 to 22,000 tons of ore monthly. The electric-furnace plant recently put into operation at Great Falls for making ferro-manganese, will create a market for nearly 100,000 tons of ore annually, so that the production of manganese ore in Montana may continue to increase.

The shipments of ore from California for the first six months of 1918 were 10,601 tons, against 12,730 tons in the whole of the year 1917. The present rate of shipment is 2400 tons per month, and it is estimated that 22,000 tons will be shipped from the State in 1918. There are 31 shippers. The Livermore-Tesla district, in Alameda and San Joaquin counties, is the source of most of the ore shipped; but large shipments are regularly made from the Chocolate mountains, Imperial county, and from the Ironwood district, Riverside county.

The shipments from Nevada during the first six months of 1918 were 12,586 tons, and during the year they will probably be 27,000 tons. The maximum monthly rate—3500 tons—was reached in April, on account of the activity of the Three Kids mine, east of Las Vegas. There are 11 shippers.

Although the rate of shipment during recent months from Alabama, Arkansas, and Georgia is slightly higher than the rate in the early months of the year, the aggregate increase in the quantity of ore has not been great. Arkansas has 10 shippers. Shipments from other States, notably from Tennessee and Virginia, have been maintained at a uniform rate, but those from Utah have declined.

The shipments of ore from Minnesota were 305,641 tons from January to June, 1918, and reached a maximum rate of 130,000 tons in July. It is estimated that 950,000 tons will be shipped from the State during 1918. The ore shipped contained 5 to 20% Mn. Several new mines are expected to reach the producing stage in 1918, but their contributions for the year will be small.

Mines (eleven) in the Leadville district, Colorado, shipped 60,804 tons of low-grade ore in the first six months of 1918; and although the average rate of output was lower during July and August there is a fair prospect that 120,000 tons will be shipped during the year. The recent decline in shipments is evidently due to the increase of stocks in the hands of established consumers and to the producer's inability to extend the market, as the mines of this district could have supplied a much larger quantity of ore containing 20 to 35% Mn than was actually shipped.

Imports of manganese ore from all sources from January to June, 1918, as reported by the Bureau of Foreign and Domestic Commerce, were 244,836 tons, which, if added to the 136,554 tons of domestic ore produced, indicate a visible supply of 380,000 tons for the half of the year. Brazil supplied 171,895 tons; Cuba, 41,984 tons; India, 22,150 tons; while small quantities were imported from Chile, Costa Rica, United Kingdom, Panama, Mexico, Japan, Canada, and Australia. Imports in July were 29,886 tons, those in August 33,975 tons. From January to June, inclusive, 18,474 tons of ferro-manganese was received from Europe. In June the imports for the remainder of the year were restricted to 12,000 tons.

To summarize, it may be said that the extraordinary increase in the output of high-grade ore in 1918 has fully offset the loss occasioned by the restriction of imports made necessary by the shortage of ships and has established confidence in the capacity of the domestic deposits to supply a considerable part of domestic need. The imports of ore and alloy, and the domestic shipments combined, have recently exceeded the current needs and discouraged some consumers from further increasing their stocks. Plans are under way for further restricting the imports from Brazil, and it is hoped that the present rate of production will be maintained well into 1919, although operators should be cautious in undertaking new explorations.

SHEET-ZINC is in great demand since the beginning of the War for lining packing-cases made for shipment overseas, especially cases containing munitions or other material that is likely to be affected by salt air. The War Industries Board has ordered the use of sheet-zinc instead of galvanized iron or steel for refrigerator linings, which will require about 10,000 tons of rolled zinc. Sheet-zinc can also be substituted for galvanized iron in roofing, spouting, guttering, garages, household utensils, and hospital ware.

DIAMOND-DRILLING in porphyry presents numerous difficulties, according to Cecil Fitch, of Eureka, Utah.

Monetary Adjustments and Gold Mining

By BLAMEY STEVENS

The Relative Importance of Gold. To appreciate an adverse condition that needs a remedy we must go to the roots of it. The world's total production of gold for several years past has averaged 450 million dollars per annum, about half coming from South Africa and a fifth from the United States. Large as these figures seem, gold mining is really only a small branch of the industrial tree. The War cost the world about one hundred times as much wealth as gold mining ever produced in any similar period, and this does not include all the other industries that were carried on to supply the current needs of the populace, while the War was on, industries amounting in the aggregate to probably three or four times as much again as the cost of the War. Although the gold miner will be loath to take this perspective of it, the world can do without gold very much better than it can do without wheat, or iron, or copper, or corn, or a dozen of other commodities.

Gold as a Monetary Standard. Before the War we used to talk of stabilizing monetary standards by using gold not only as a basis of value, but also as a guarantee of value, resting assured that gold in quantity was necessary to back currency, and also, by its free flow from one country to another, to correct effectually the standard exchanges between these countries. The War, however, has told us that this was a theory based on special conditions, and we see Great Britain holding a fairly stable standard of American exchange with only minor metallic reserves or commodity gold to use for international adjustments.

Gold as a Convenient Commodity. We may henceforth look on gold simply as a convenience, and the lack of it as an inconvenience, not a condition of monetary famine. When before the War there were more orders received by the banks of one country from another country, for payments, than could be balanced off in return orders, the exchange or ratio of monetary standards varied, and a flow of gold was promoted, from one country to the other, which tended to correct that variation. The shipping of copper, or wheat, or corn, or coal, or any other common commodity would have corrected this balance, but the freight would be greater, and to this extent only is gold preferable to other commodities for the purpose of adjusting foreign exchanges, and not because it has anything to do with monetary standards.

Promissory Paper for Gold. During the War the gold reserves of the Allies were much reduced and at the same time the pound sterling fell somewhat in value, as measured in dollars; not because there was any fear of currency not being redeemable in gold, but because there was no further supply of commodities, including gold, to adjust the adverse trade-balance with Great Britain. This balance had to be taken care of in other ways; one way was a sale in America of securities that had been held in Britain, and another way was the placing of loans in the United States. The latter is a promise to return American money at a future time, but that payment when it becomes due may almost as well be made in other commodities as in gold. The fact remains that at the present time the commodity exchange of gold has almost disappeared and there is left simply a promise to pay, based on American currency (paper money), but actually payable in any commodity that can be sent to the American markets in exchange for such currency. The ratio of money-standards might be retained indefinitely, and even bettered or perfected by a continual adjustment of credits between the two countries, without any use of gold whatever. A government whose honor, solvency, and future were absolutely beyond question would hardly need any reserve of gold at all to guarantee its currency, as long as it bought and sold its own securities freely at prices that would just prevent any appreciable demand on it for gold. In this way trade-balances would be adjusted directly or indirectly with securities instead of with gold. If governments had been competing financial corporations, like banks, they would undoubtedly have done more than they have in providing for such trade adjustments; the miner has benefited by the liberality of the politicians. There is now over three billion dollars worth of gold in the United States, about half of which has entered during the War, and, this half may certainly be called an excess over the most urgent needs of the country. By holding this extra gold, the people pay interest to the extent of over sixty million dollars per annum, which is probably as much as the whole expense of straight gold mining in the United States at the moment; in other words, if the Government put this excess gold out at interest, it could keep all the gold miners without their having to work at all, or if it required them to work, it could put sixty million dollars worth of new gold into the Treasury without drawing anything on the world's present supply.

Substitution of Confidence for Gold. The internal economic system of the United States has not been without parallels to the foreign exchange conditions just mentioned; gold payments have in the past been entirely suspended and only resumed when economic freedom was entirely restored. In the interval there was nothing to sustain the value of the dollar but confidence in the future of the Government. Similarly, in trade and industry use is made of the deposit currency system where confidence is placed in a bank having reserves of, say, only 15% of its deposits. Little money is used, business being done by means of checks, which is a

method the banks have invented to save them carrying a larger percentage of currency in proportion to deposits, which extra currency would be so much wealth, bearing no interest, and therefore a virtual loss.

Under the old system, the National banks bought from, and deposited with, the Government, the interest bearing bonds that served as security for the currency they issued. This remunerative system allowed for little flexibility of currency and was replaced just before the War by the Federal Reserve banking system, whereby currency is issued against commercial paper (promissory notes, etc.), and secured by a gold reserve of 40%. Although this is sufficiently remunerative to the Federal Reserve banks, it is seen by the light of war experience that there is locked up in the vaults a very large sum in gold that, if it were owned by the Government, could be mostly put out at interest without causing any want of confidence on the part of the public, which in the end necessarily pays the bill.

Necessity of Staple Exchange. The extent to which all the above mentioned ways of dispensing with gold are carried is for the most part a matter of convenience and there are in general two opposite conditions fixing the amount of precious metal it is most convenient to carry. If we wish to measure off a mile, we may have a tape a mile long or one only a foot long. The most convenient way, however, would be to have a tape about a hundred feet long. Too much gold is an inconvenience to a government because it does not bear interest; it is obvious that there is also a lower limit.

When the European countries that have been at war go back to international trading they will have too little gold to be convenient. Confidence is well enough so far as it goes, but there is no exact measure of it and large foreign business has to be done on narrow margins of exchange. If the American merchant buys goods in Europe on three or six months credit, he will want to know precisely how much they are going to cost him when the payments become due. When the ratio of standards was preserved altogether by a free exchange of gold he knew precisely, and under present conditions, involving so many unknown factors, gold exchange will still be necessary. Lloyds might guarantee against losses from instability of exchange, but the charge for such insurance would be equivalent to an adverse difference in price and would act against the country where that charge was greatest. Other things being equal, therefore, the country with the most stable exchange will be the most profitable to deal with, and consequently there will be great competitive efforts made by European countries to protect their exchanges, both with commodity gold and by every other device we have mentioned.

Stabilization of Exchange. Most of the European countries that before the War were financially strong and could to a large extent have substituted confidence for reserves, are now weak, and, in fact, not far from bankrupt. When a business concern is known to be financially weak it is necessary for it to do business in cash, instead of in credit as a financially strong concern can do. There is no lack of experience with such countries. They have for a long time been rather the rule in the Americas than the exception. We may not expect that specie will be used exclusively as in India, but we may take the following two phases from Mexican experience as being illustrative of the extreme conditions to be anticipated in Europe.

In the times of the Diaz and Madero administrations, the Government itself did not form so much a basis of confidence, but what it lacked was supplied by banks having foreign backing and ostensibly independent of the possible want of permanence or responsibility of the Government or of its acts. Although such banks were much more than solvent it was necessary, in order to sustain a fixed foreign exchange, for them to keep a metallic reserve of 50% of the face-value of currency issued and to exchange freely for specie upon demand. If the Government could have sustained the currency with less reserve, it would certainly have done so.

The second illustration may be taken from the happenings of the year 1916, when after some years of continuous revolution the Government's own paper was the only currency, and there was no confidence whatever. A certain amount of currency was required for internal business, but some internal and all external transactions were done in foreign bank-drafts, mainly on New York. In the absence of a fixed foreign exchange, however, business was extremely difficult to transact as the burdens of foreign exchange variations was thrown on the retail merchant. All business was therefore much restricted, being only promoted by the chance of making exorbitant profits at the expense of the consumer. Finally it was recognized that the Government would continue indefinitely to increase the total face-value of the currency by issuing more and more of it; consequently foreign exchange had a continual downward trend. It was not a gamble to retain currency even for a few days but a sure loss, and no more of it was held than could be helped, arrangements being made when possible to buy one thing before another was sold to get the necessary money. From this cause the total intrinsic value of the currency in commodities and wages was much restricted. As, however, no one wanted a bank account, and no bank would keep one, Government currency was needed for all transactions.

In the last mentioned case it is seen that the value in some staple standard of the total amount of currency is equal to the total amount in business transactions taking place in a day multiplied by the average number of days the currency is held between being received and being paid out again. This principle applies universally to currency, because when some of it is hoarded the time the total currency is held is increased in exact proportion to the relative amount hoarded. When business is done by check the total value of paper so passing through the banks is the amount of business in 'deposit currency' and must be added to the business done in legal currency. Also, before the principle is applied the total amount of currency must be understood to include the bank de-

posits. In New York city the rapidity of business transactions is such that the whole volume of deposit currency, amounting to four billion dollars, may be said to be drawn from and refunded to the banks once a week. Bills of exchange and other forms of 'credit currency' may also be understood as currency at their face-value and each endorsement represents an extra business transaction of the same face-value. Promissory notes may also be included, these being considered as separate loan transactions and entailing an extra item of business, even when they are paid for goods, because this amount of extra currency is presumed to exist during the life of the note. Commercial paper, rendered convenient by mutual confidence and stable standards of exchange, is so flexible that the total volume of currency substitutes adjusts itself to the standard exchange instead of the exchange having to adjust itself to the volume of currency. In countries where such a system is not well developed the foreign exchange cannot be stabilized even when it is entirely metallic. Such, for example, is the condition in Mexico at the present time, its gold currency being at a premium because it is short of the present demands, and other or foreign speecie is not legal tender even if obtainable. If, on the other hand, the Mexican government had forced the hoarding of it within the country, the exchange would have gone in the opposite direction, as people do not usually want wealth that produces no interest.

It is entirely probable that in the various European countries that have been at war conditions of foreign exchange will be in vogue, varying all the way between the extremes of Mexican economics.

GRESHAM'S LAW throws an instructive side-light on the function of money. It states that when there are two or more kinds of money in a country, that one tends to become current which has the least stability and the other more staple money is held by individuals to be used only on emergency. This is precisely what has been happening in European countries that have introduced paper currency where previously there was a metallic one. There is thus stored away out of sight a considerable volume of gold and silver. Gresham's law arises from the well-known fact that a holder of the commodity in least general demand has to exert himself most to sell it. The general commodity needs little advertising, the special one a great deal. If a manufacturer of copper ingots can put his product on the market at a tenth of a cent per pound cheaper than his competitors he can sell all his output without any advertising at all; but the manufacturer of sewing-machines has to spend about 100% on the manufactured value in order to sell his product in the face of competition; merely cutting the price a small percentage does not suffice. Now, currency is the most general commodity there is and when the owner of it offers it in exchange for a less general commodity he has the option of choosing the least staple form of it and making the owner of the less general commodity take the risk; in fact, the latter can well afford to do so, as an immediate acceptance of exchange for currency rids him of further selling expense to that degree. There is a limit to the extent this law applies, however, because when currency becomes too unstable the owners of commodities prefer to hold them to selling them in the unstable form of money. The consumer is then forced to draw from his stock of more stable currency in order to live. This is what happened in Mexico in the latter part of 1916 when, almost over-night, Government paper was thrown into disuse and gold and silver specie, which had been hoarded, came into general use.

ESTIMATE OF CURRENCY. In countries such as India, where the use of banks is not universal and coin is apt to disappear from one cause or another, the following method can be employed advantageously: A large number of coins are marked or a peculiar issue is made and on a fixed date these coins are fairly distributed by the banks of the country. Each day, week, month, or year thereafter the banks count the amount in marked pieces returned and compare this with the whole turnover for the same time. The currency in circulation then holds to the turnover of the banks the same proportion as the total number of marked coins distributed does to the number of those returned in the particular period during which the turnover was taken. During the first days, weeks, or months the marked coins are being distributed among the outlying population and the estimate of total currency obtained is therefore too small. Later on the process of hoarding becomes evident, so that after a number of years the figures obtained can hardly be called currency in circulation, but are more nearly the combined amount used up in the arts, hoarded, and in circulation, to which combined amount the figures approach asymptotically. Corrections have, of course, to be made for additions to circulation, the relative effect of these additions at any given time being proportional to that found for the marked coins. Variations of the method explained may be used to advantage and they gradually merge into that of replacing new kinds of currency in known amounts for old, which are withdrawn from circulation by the Government.

THE WORLD'S AVAILABLE GOLD is a large static quantity; there being about nine billion dollars worth visible and no one knows how much more is kept out of sight. It is not like most other commodities, which are mainly consumed as they are produced. A year's supply of gold is less than half a billion dollars worth and only alters the total amount in use or reserve by a small percentage. Consequently, no one but the miner worries much about the amount being mined. What they do worry about is how to get some of the big pile that has already been mined. At the present moment a large part of that pile is in this country, and not the least problem of the European nations will be how to get enough of it over to their own countries so as to stabilize their monetary exchanges and give other nations assurance as to the precise exchange-value of the commodities they buy or sell in the money of those countries. The loaning of gold to the European countries would not only

be good business on the part of the United States, because of the revenue the investment would bring, but it must be obvious that it serves this country no purpose to stabilize its currency to any greater extent than that of the country having the next most perfect stability of currency. It is abundantly clear that internal prices of wages and commodities have in these days nothing to do with the standardizing of money; what counts is the stabilization of foreign exchange, and that is a relative quantity in which two or more countries must necessarily take part.

Oriental Demand. It will be seen, therefore, that so far as the above causes go, the gold to be mined in the near future is an uncertain residual quantity, a difference between a large supply and a large demand, the latter of which cannot be exactly estimated. With the decreasing production of silver and the increasing trade of India, China, and their neighbors, there is a large yearly demand for gold, which is practically consumed. How much is hoarded as coin and how much goes into jewelry is hardly known. In the last ten years India has consumed in coined gold almost half a billion dollars, or more than 10% of the world's production. Normally the rest of the world consumes about 13% of the production in the arts and some further quantity of coined gold disappears so that probably about one-third may be considered to be consumed and this quantity must necessarily be supplied by the mining of new supplies.

Probably about 20% of the world's gold is produced as a by-product in the mining of silver, copper, lead, and zinc, and about 30% is mined in countries of low wage-scale that are not affected much by outside economic conditions. It is quite possible therefore that the effective pinch inducing suitable economic conditions for the mining of gold in countries of high wage-standards might be a long time in coming if there were no other forces at work toward that end than the mere scarcity of the precious metal.

Artificial Economic Conditions. From the economic point of view, war is an artificial condition. The ordinary forms of competition between individuals and groups of a few individuals is dispensed with or becomes subsidiary to the larger grouping along lines of nationality. The making of great loans by the United States to the Allies has not been prompted by business judgment but by the necessities of war. Internally the free exchange of gold for currency has been curtailed. Wheat is no longer handled competitively; not a grain is bought or sold on the floors of the produce exchanges of the country. Most other basic industries are largely under Government control and internal competitive conditions have in general been destroyed. Europe has not been manufacturing commodities for foreign markets and free international trade conditions have been, for a time, eliminated. In fact, the whole economic structure is artificially propped up on every side so that natural adjustments do not any longer take place. The question now comes as to how the props are going to be removed without knocking them out and thus cause a catastrophe.

Natural Economic Equilibrium. No one believes more strongly than I do in the desirability of allowing natural functions to adjust themselves. But when artificial conditions already exist they must be removed by artificial means, little by little. One keeps health best by obeying nature, but having substituted artificial conditions of living one must generally resort to artifice to reduce the shock of a too sudden return to nature, which might prove fatal. It is not to be expected therefore that unconstrained economic conditions can be resumed without the aid of some artificially created spring or buffer interposed for the purpose of preventing the injurious economic impact that would otherwise result. Before we can say what is the best artifice to be employed we must know precisely what are the evils to be met; what kind of an impact has to be avoided.

The Evils to be Faced. A large part of Europe has been used to subsisting on foreign trade. In this country that kind of trade has heretofore been only incidental. The European countries will try to come back to the economic standards and conditions that make foreign trade most profitable, and then, as the more pressing needs of the market are satisfied, to those refinements which are necessary in keen competition for foreign trade, one of them being gold reserves. A concern under heavy financial strain will sell almost anything it has in order to pay its pressing debts. Besides the principal of the debts that Europe owes and is still accumulating, there is the interest to be taken care of, all of which, as far as the United States is the creditor, has to flow into this country in the shape of commodities, over and above the pre-War amounts, which were limited by the volume of exports, mainly of food and raw material.

In the absence of any artifice to prevent it, the American market will be over-run with European goods. Thousands of people in the East are trying to figure out how they can profit from this condition. If no means is taken to prevent it, the working-man, not realizing what is going on, will persist in retaining his high wages; factories will knock off hands or proclaim lock-outs. Great numbers of men will be thrown out of employment; bread-lines will form, and finally, after no one knows what ignorant strife, a lowering of wages toward the European level will result inevitably.

The Cure Suggested. The evil to be avoided therefore is in the lowering of wages and the question is as to whether to have an artifice to prevent this lowering of wages or to have one to accomplish it in a proper and orderly manner. The only practical artifice to prevent it would be a high tariff-wall to keep foreign goods from being sold on the American market. It may be seen, however, that this would be only a temporizing measure, for the country can never enter beneficially into foreign trade in manufactured goods unless it opens its doors. The natural resources of the country are such that little raw material is needed from the outside, and if manufactured goods cannot enter, no immedate benefit will be

received from excess of exports. The first problem is to get immediate material benefit of commodities from anywhere and not to accumulate more credits. The great consuming fire over in Europe has had to be fed for years and the country is in need of everything it can obtain from the outside so long as it can absorb it and at the same time keep its own industries producing to their full capacity. The great problem of which we are speaking comes after this absorption period. The undertaking of extensive constructive work by the State might temporarily relieve the distress from over importation, but such a measure would not be final.

This country, in the course of its development, has reached the stage where it can support itself independently of outside aid. It can manufacture everything necessary for the consumption of its own inhabitants, and its own resources and basic industries can supply everything necessary in the way of raw material. This stage of development is a very desirable one, from the point of view of war possibilities, because no blockade can have any effect. This end has been reached by a minor blockade, called the tariff, which has in this sense been a sort of mild preparation. The dog learns to fight when playing as a pup, or the cat to support itself by playing with a ball of wool when a kitten.

This condition of independent self-support is, however, not the condition of maximum continued prosperity for the people; it is not the condition where the laborer can in the future obtain most commodities for his daily wages or where the continued expansion of industries in proportion to increase of population and increase of efficiency of labor can take place to the best advantage. Already before the War, in 1914, there was a sort of tightness to be felt in the condition of expansion and the pendulum had swung in favor of lower tariffs. It was beginning to be seen that some things could be manufactured to better advantage in other countries and that home industries could be concentrated to better advantage on the manufacture of the things it paid to export. Naturally there was always the opposition of the unsuitable industries, both of the capital so employed and of the labor. There was also the delusion of the average workman regarding the reason for the standard of American wages being higher than that of Europe. Except in so far as superior natural resources may be of advantage, the relative wage conditions in one country can be of no advantage to it, if in any case the wage-earners consume the full value of all the commodities produced. The higher wage may simply mean that the price of commodities is raised in the same proportion as the scale of wages. On the contrary, the condition of greatest prosperity for all the people of the country will now only be reached when the trade-doors are opened wide and there is a free interchange of commodities. Natural resources are not in any case restrained from flowing out of the United States and other commodities have to be returned for them—unless foreign investments are made. Consequently, it pays best to have returned those articles which can be produced to the best advantage in other countries. Money does not come into the question at all. It simply cancels itself out in the two operations of selling one thing and buying another. What we must consider is the resultant exchange of commodities, and in the end the people can get out of the country just exactly what it produces in raw material plus their own efficiency in doing the work which gives them the best living, not in money, but in everything they need to live with.

Certainly the country has benefited in the past by there being fewer people to take advantage of its natural resources, and in the scarcity of labor it has benefited by the incentive to greater efficiency. As more people came it continued to benefit by finding employment in artificially protected industries for what otherwise would have been an excess of population. But a time has come when the measure is full and ready to overflow. There is still the advantage of raw materials conveniently situated, but the manufactured goods produced are sufficient for all the people, and except for the country's advantage in natural resources and greater labor efficiency, which it will retain in any case, it is virtually on a par with Europe, and the consideration of relative monetary values simply confuse the issue.

In order to deal with the problem definitely it is obvious therefore that commodities produced must be reduced in price, so as to partly meet foreign competition, and to obtain this end wages must also be reduced. As an artifice is required, why not make it as clear and open as possible so that neither the workman nor the manufacturer may be suspicious? In other words, why not gradually reduce the average price of commodities, and as the reduction is officially reported, reduce wages by similar percentages all around?

Objections Answered. It may be answered that the workman would not understand. The reply to this is that a considerable part of the workmen do already understand. About thirty years ago sliding-scales of wages were established in the coal mines of England. Wages were made to vary with the price of coal. Since then the idea has been gradually cultivated and of late similar sliding-scales have been regulating the wages of a large part of the copper-mining industry in the West.

In purely manufacturing industry where there are also raw materials to be bought at varying prices and there is no regular product, such as ingots of copper, it is not possible to arrange sliding-scales on the basis of any particular commodity. Normally it is not as necessary to do so, because most prices do not vary like those of copper. There is, however, something that affects the workman much more intimately than the price of copper affects the copper miner, namely, the price of the average commodity he has to buy with his wages. If the artifice is arranged so that he will be able to get just the same commodities with his wages as he does now, until normal conditions are resumed, he can be satisfied; that is to say, if his desire and that of his leaders is to prevent trouble.

There is no necessary limitation to the activity of the

trade-unions involved in the above plan. If in a certain section of the country and during a certain period, a 5% reduction in commodities had been effected, then an order would be issued by the central authorities for a reduction during the next period of 5% in all wages. This would in no way be interpreted to prevent a strike in any certain factory for a raise of, say, 10%, and such strike would adjust itself along ordinary lines.

If the manufacturer objects because he considers his prices would be artificially cut, it might be replied that no cutting would be necessary in most branches of industry. This will occur by anticipation of foreign competition and by anticipation of the lowering of wages. Naturally, though, during the process of reduction there will be hand to mouth trading. No one will want to carry any more stock than is absolutely necessary, either of raw material or of manufactured articles. This, however, will be no innovation but simply a continuation of the conditions created by the War.

If the manufacturer considers that factories would close down during the reduction process, the reply is that this will only happen if the initiation of the reduction process is delayed. It is simply a race between European and American factories, and if the latter cannot compete for the home consumption while Europe is supplying the crying demands of the rest of the world, they had better give up all idea of competing for foreign trade later on. No one can deny that to begin with, European prices will be high, but it will be a grave fallacy to presume that they will remain so. The world has to a considerable extent learned to do without many things which were previously supplied from Europe. European capital for foreign construction work will be largely wanting, thus further decreasing the demands for equipment manufactured in Europe.

When to Discontinue Artifice. As determining when this process should be discontinued, the normal conditions above-mentioned should however be in no way based upon the cost of production of gold but upon the disappearance of any abnormal tendency for the movement of gold after all countries have a proper share of that metal.

In the manner above described the flooding of this country with cheap European goods would be avoided. Simultaneously attempts to sustain wages, resulting in the closing of factories and the formation of bread-lines, would be corrected by mutual consent in such a manner as not to affect the workman either in the purchasing power of his wages or in his right to strike for an increased purchasing power. It should not affect the American employer because it would only be carried at each stage to the extent necessary to prevent adverse trade-balances with foreign countries and internally all would be in the same boat, though the basic industries would doubtless enjoy most prosperity. The present precarious conditions would then be gently relieved of the artificial props and finally the sun might shine on the little branch of the industrial tree on which sits the gold miner.

Milling the Bawdwin Mines Ore

The mines of the Burma Corporation in upper Burma, India, are estimated to contain 4,033,000 tons of ore assaying 24.7 oz. of silver, 27.4% of lead, 19.1% of zinc, and 0.4% of copper; also 105,000 tons averaging 21.0 oz. of silver, 19.9% of lead, 8.8% of zinc, and 8.9% of copper. During 1917, according to the report just to hand, only high-grade lead ore for the smelter was extracted, also some zinc ore for export. Construction of the new 1000-ton mill was commenced near Namtu late in August of last year.

After discussion with the staff at Namtu, it was decided to divide the program into two stages; a preliminary system that would convert a maximum proportion of the lead, zinc, and silver into standard metallurgical products, with only secondary attention to total extraction; and a final system that would give maximum recoveries with less rigid requirements as to classes of products, according to the report of Lawrence Addicks.

The preliminary flow-sheet included crushing the ore to ½-in. size. Jigs would yield a lead concentrate and tables a zinc concentrate and gangue, the latter to be stored. From the middling would be a slime product, while the coarse material is ground to 200-mesh. This product would have a soda flotation, producing both zinc and lead concentrates.

The final flow-sheet included crushing the ore to ⅛-in. size. Jigs and tables would give similar concentrates as in the preliminary method. The gangue from the tables would be ground to 80-mesh, given an acid flotation, yielding gangue and middling. The table middling gives slime as before, this to be given acid flotation, from which would be produced gangue and middling. All of the middlings, constituting 51% of the weight of original ore, and assaying 27.3% of lead, 29.9 oz. of silver, and 29.0% of zinc, might then be treated by some chemical process. The gangue would be 19% of the weight of the ore, carrying only 2.5% of lead, 4.0 oz. of silver, and 2.0% of zinc.

The general program recommended is: (1) That average ore be sent to the mill operating on the preliminary flow-sheet previously described. (2) That the lead concentrate produced be treated for the time being at the present Namtu smelter, with such temporary capacity additions as may be required, any excess base bullion over refining capacity being exported to England. (3) That a zinc-retort smelter and acid plant to treat 25,000 tons of zinc concentrate per year be erected at once at Sakchi, India; any excess concentrate produced being sent to England when shipping conditions permit. (4) That the experiments already under way for the choice of a suitable process for the treatment of middling be prosecuted vigorously, and that upon satisfactory results a commercial plant be erected in England. And (5) that final decision as to the ultimate mill flow-sheet, modern lead smelter, etc., be deferred until both the post-war probabilities and the results of the metallurgical experiments are reasonably certain.

EUREKA, CALIFORNIA

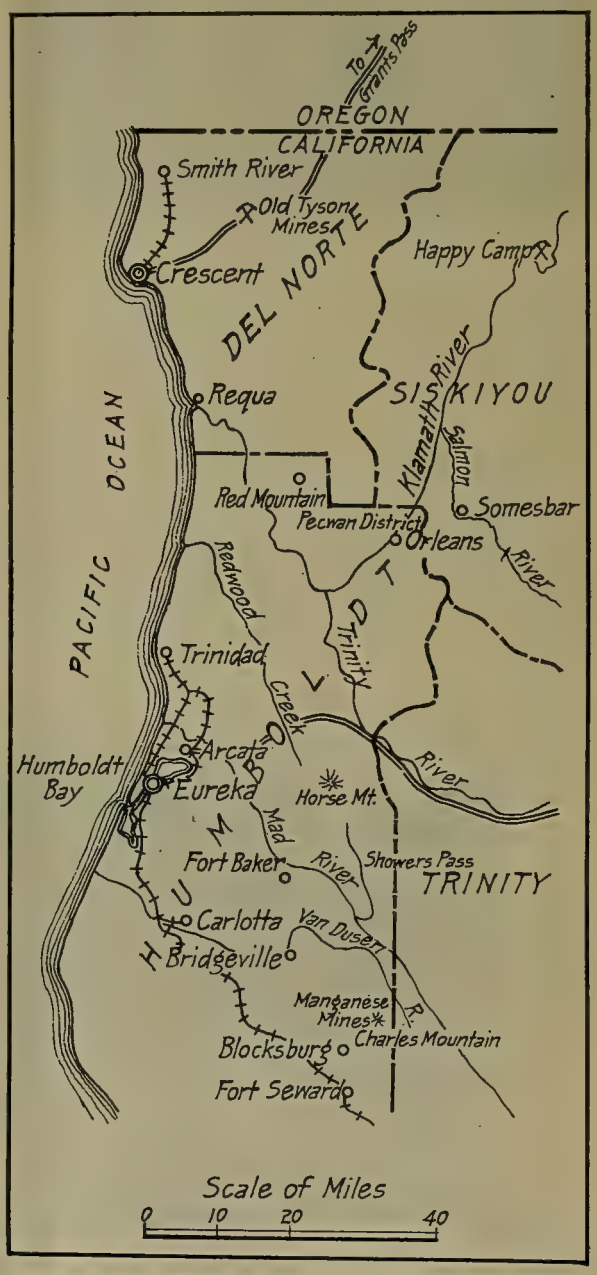
Chrome and Manganese Mining in North-Western California.

Mining operations throughout north-western California have ceased for the winter, recent rains having made the roads impassable. This applies to chrome and manganese mining in Del Norte and Humboldt counties, in both of which there has been unprecedented activity during the past season. The future of these war minerals, especially chrome, is a subject of much discussion among local mining men, and one on which there is a wide divergence of opinion. Many new deposits in Humboldt have been opened through the expenditure of large sums of private capital in order to meet the Government's urgent demand for chrome, and these men may lose heavily unless immediate steps are taken to steady the market by the time weather conditions permit resumption of mining in the spring.

The chrome belt in north-western California extends from Del Norte and Siskiyou on the north, in a southerly direction along the border between Humboldt and Trinity counties, in the form of a triangle with the base resting on the Oregon boundary line. This is known as the serpentine belt. Taking in the greater part of Del Norte and western Siskiyou, the region comprises the Orleans district, and includes the Red Cap mountain on the Klamath river on the one side and the Slate and Bluff Creek regions on the other side of the stream, thence down Trinity river following the range of which Horse mountain is part. The manganese belt extends through the southern part of Humboldt county. The largest occurrence of this ore in the State is said to have been located in the Fort Baker range lying between the Mad and Van Duzen rivers. The richest ore is in the Charles Mountain district near Fort Seward. Manganese was also mined in considerable quantities in the Alderpoint district during the past summer.

Roughly estimated, the total quantity of chromite passing through Eureka during the past season was upward of 125 carloads, approximating 6250 tons, By far the greater part of this came by schooners from Crescent, which is the natural outlet for the rich chrome mines of Del Norte. The groups of properties, including French Hill and the old Tyson mines, the Rattle Snake, the High Plateau, and the Preston Peak districts, operated by R. D. Adams of San Francisco, have shipped about 3500 tons by way of Eureka; while the California Chrome Co. sent out upward of 1000 tons. An estimate made in August last showed that the Del Norte output consigned to Eureka for transfer and shipment by rail was about 4000 tons. A large quantity was also sent from that section by the Hobbs, Wall & Co.'s lumber steamers plying direct between Crescent and San Francisco. The Red Mountain mines on the Klamath, and those in the Pecwan district in lower Del Norte, also mined several hundred tons, sending it down the Klamath, where it was transferred from truck at the Requa docks thence by schooner to Eureka to be shipped by rail to San Francisco. In Humboldt county, the principal chrome producers have been the Horse Mountain Copper Co.'s mine and the adjoining property of the Humboldt Copper Co., situated in the serpentine belt that extends along the eastern border of the county. The Horse Mountain mine supplied 350 tons during the past summer.

The difficulties under which all these ore deposits were opened and sent to distributing points from which they



MAP OF NORTH-WESTERN CALIFORNIA, SHOWING CHROMITE DEPOSITS

could be shipped can only be thoroughly understood by a study of the topography of the country in which they occur. In the early 'fifties, the chrome occurrences in Del Norte were practically the only known deposits in America, and those accessible from Crescent were mined extensively to supply the domestic demand. The entire section is a rough, heavily-timbered, mountainous region, making construction of roads to the properties a difficult, and in some instances, impossible task. Accordingly, when the mines farther east found an outlet through Red Bluff and other valley ship-

LOADING BURROS WITH CHROMITE AT THE TOP OF RED MOUNTAIN, HUMBOLDT COUNTY, CALIFORNIA

ping-points, the coast mines closed down or ceased to operate except on a moderate scale.

The difficulties of road-building that presented such obstacles in the early days have been again encountered by the chrome miners operating in Del Norte and Humboldt counties during the past summer. However, the high price of ore, and the tacit understanding that the Government would ensure a market for the product during a period of one year following the signing of the peace treaty, led to the expenditure of large sums in road construction, also in building ore-bunkers and accommodation for employees, etc. The road leading into the High Plateau district is estimated to have cost the Adams people about $24,000. Plans were outlined for the construction of another road to cost twice this sum to serve another of this group of mines, but work has been delayed or indefinitely postponed by winter. The Board of Supervisors of Del Norte used the entire amount ($12,000) of the county budget set aside for road-building for the improvement of the main 'artery' that served as an outlet for the mining districts. This is the Grants Pass road and will later become a part of the State highway.

The difficulties that have overtaken Mesler and Mitchell of Eureka, operating the Red Mountain mines on the Klamath river, 14 miles from Requa, is an instance of circumstances that operate against Californian chrome men. These properties contain large chrome deposits lying near the top of a 4000-ft. ridge. To get the ore down to the river level, it was necessary to cut a precipitous trail seven miles long for a pack-train. Several States were visited in an effort to get a sufficient number of pack animals, and a train comprising 34 mules and 55 burros was finally assembled. The ore was transported by these from the mines to the river, thence down the Klamath to Requa, where it was sent to Eureka. Notwithstanding these difficulties, quantities of excellent ore were extracted. The company had planned the construction of an aerial tram, which, with the widening of the 4-ft. Federal trail following the river, would have greatly expedited transportation of the ore. Then came the unexpected slump in the chrome market, with the result that the holdings of the company, including 150 tons of ore lying on docks at Eureka, Requa, and the mine, are held under attachment by creditors, and the company faces a loss of $25,000.

The old Tyson mines, in the Smith River section, that were closed when chrome was selling at $8 per ton, and have lain idle for the past 38 years, were unwatered and cleaned out at great expense to the R. D. Adams company. The difficulty of obtaining machinery and the scarcity of labor were other things that delayed work until late summer, so that the first carload of ore from these holdings did not start to market until September. The Adams people are still shipping some ore from Crescent as weather conditions will permit, a contract protecting them in a measure from the sudden slump. It is estimated that this company has now approximately 1000 tons available at Crescent and the mines operated by them nearby. This will be shipped as rapidly as possible.

Recent news from Crescent indicates that the 'fleets' of

VIEW SHOWING THE KLAMATH RIVER AND CHARACTER OF COUNTRY IN THE RED MOUNTAIN CHROME REGION, HUMBOLDT COUNTY, CALIFORNIA

trucks engaged hauling ore in that part have all been called in, and that shipments of ore from there will consist henceforth of that lying on the wharves.

The outlook for manganese miners in southern Humboldt county is much brighter than in the chrome field, as there continues to be a good market and the companies are largely protected by contracts. This group of mines, including the Fort Baker, Charles Mountain, and Fort Seward deposits, are operated by Irving and Doak of San Francisco. Work is now at a standstill on account of rain which has put the roads out of commission. However, it is expected that work will be resumed in the spring on as large a scale as that of the past summer. Similar transportation difficulties were encountered in getting manganese as in chrome mining. Seven trucks were employed to get the ore out to the shipping points on the Northwestern Pacific railway, and it was necessary for the company to construct many miles of new road-bed for this purpose. The Fort Baker ore was trucked 29 miles to Carlotta, five miles of which was constructed by the company at a cost of $5000. The output from Charles Mountain and Fort Seward was trucked to Point Seward, construction of four or five miles of new road being necessary in this instance also.

The total output marketed from the three mines during the past season was 1300 tons. There are 3600 tons blocked out at the mines, to be moved in the spring. About 11 carloads of ore were taken from the Fort Baker mine, and a similar amount from Charles Mountain, the latter having some of the richest found anywhere in the country. The mines above Fort Seward yielded seven carloads, averaging 45 tons per load.

CRIPPLE CREEK, COLORADO

Gold Output and Dividends.—New Orebodies in Small Mines.

The November gold output, the lowest for the year, due to the epidemic of influenza, causing mines and mills to work short-handed, in some instances to suspend operations, totaled 68,476 tons averaging $10.14 per ton, making a gross value of $694,963. Compared with the preceding month there is a decrease of 20,476 tons and $160,310.

Some individual returns were:

Mine or works	Tons	Average per ton
Golden Cycle	25,000	$20.00
Portland	29,426	2.13
Vindicator	1,500	1.75
Big Toad	800	4.20
Smelters	1,750	60.00

November dividends were limited to the monthly distributions of the Cresson of 10c., or $122,000, and Golden Cycle 3c., or $45,000.

The Acacia Gold company has closed its South Burns mine on Bull hill for the winter. The W. P. H. Leasing Co. also closed the W. P. H. mine of the United Gold Mines Co. on the same day, for the winter.

A new surface orebody has been opened on the Ella W. on Tenderfoot hill, not far beyond the corporate limits of Cripple Creek, by M. Johnson, lessee. The ore is worth $10 per ton.

The shoot on the 950-ft. level of the Jerry Johnson is persisting. It is now nearly 50 ft. long, and the ore shipped carries close to 2 oz. per ton.

A new vein at the Longfellow on Bull hill has been opened by the Excelsior M. L. & E. Co., lessee from the Stratton estate. The orebody is 14 ft. wide. The screenings will carry 5 oz. per ton.

The Modoc company sent three cars of 5-oz. ore to the Golden Cycle mill during November. Seven machine-drills are working, two on ore at 1200 ft. and five on development. A. H. Frankenberg is manager.

BUTTE, MONTANA

The Manganese Situation Here and at Phillipsburg.

The armistice had the immediate effect of curtailing manganese mining in Montana. The reason for this is the ability of Eastern steel interests to secure transportation of manganese ore from Brazil and Cuba, thus reducing shipments from the West to quantities specified in contracts. The effect of the decreased output will scarcely be noticed at Butte, because of the relatively small number of men engaged exclusively in mining manganese. In the Phillipsburg district, however, the situation is much different.

The Emma mine is the largest producer of manganese ore in the Butte district. It is operated by the Anaconda under a long-time profit-sharing agreement with the owners, the Butte Copper & Zinc Co. The output of this mine during the War was said to be approximately 10,000 tons per month of rhodocrosite, 8000 tons of which was shipped to Eastern consumers, and 2000 to the ferro-manganese plant at Great Falls. The yield at present is 2500 tons monthly. It is thought that the ferro plant at Great Falls can be kept operating at its present capacity and compete successfully with foreign ores as far east as Chicago.

The Phillipsburg district will probably return to its prewar basis, because of the lessening demand for Western manganese ore in the East. The Phillipsburg Mining Co. has contracts for delivery of manganese that will keep it busy until spring. But several other companies are not so well situated, as they have spent large sums on development and new equipment, expecting a continued demand at the Government price, and are now in a fair way to lose on their investment, as they had just reached a profitable basis when the slump came.

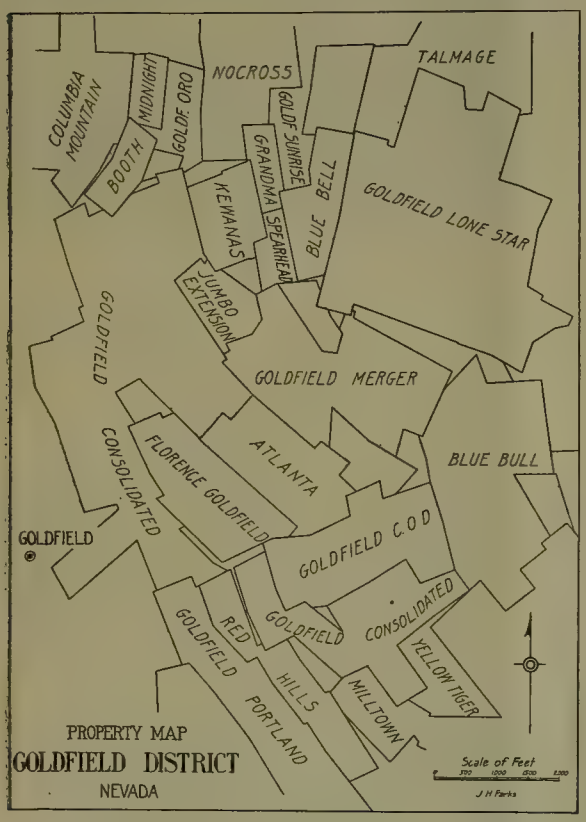
GOLDFIELD, NEVADA

Current Development Work in the District Detailed.

Discoveries of pay-ore on three deep levels in the Goldfield district, together with plans for expanding work on other properties, have caused a revival here. About mid-November, seams of good ore were cut in the Spearhead, in extending a south drift on the 910-ft. level. The drift has progressed farther to the south-west, in the contact zone between the latite and shale, exposing other and wider veins of good ore; while a cross-cut to the south-east has shown ore of similar grade in passing through 30 ft. of quartz lying immediately upon the shale. This ore-channel lies in direct line on the easterly dip of the shale with the contact orebody opened four years ago in the Jumbo Extension mine, a short distance to the west; and the Spearhead workings are said to be within less than 100 ft. of the east side-line of the Sunflower claim of the Merger Mines Co. The samples obtained by the superintendent, H. F. Bruce, over widths varying from 18 to 36 in., assayed from $42 to $200 per ton in gold, silver, and copper. The ore is the typical deep-level ore of the district, treated by smelting. The discovery was made in virgin ground, nearly a claim's width from the nearest point where the contact zone has been penetrated. The new ore-shoot appears to bear out somewhat the theory of H. V. Winchell, Jr., W. H. Wiley, and others, who studied ore deposition here in connection with the Booth apex controversy. They considered that enrichment would be found to extend toward the axis of the syncline formed by the shale, rather than along the trend of the ore-channel that parallels the syncline, and that farther west and north is related to the great Columbia Mountain fault. These geologists conceived the presence of barren areas in the zones extending downward along the rather flat incline of the shale, but advised further prospecting of the contact channel in line with the dip of known orebodies. During the period that the rich Jumbo Exten-

sion orebody was being developed, the Merger Mines Co. extended a long cross-cut from its main St. Ives shaft on the 1100-ft. level to the north-east, then north along the west sideline of its Sunflower claim. Difference in shaft elevation brings this cross-cut to less than 100 ft. below the Spearhead 910-ft. level. If the Spearhead orebody extends into Merger ground it can be reached from this Sunflower cross-cut within approximately 500 ft., or from one of a series of incline and vertical raises above this cross-cut.

Deep work in the Atlanta mine, impeded for a time by the shortage of labor, has made satisfactory progress. A raise from the 1850-ft. level, following the incline of the shale foot-wall, lately exposed an ore-shoot that is being developed by drifts, and is showing 6 ft. of shipping-grade ore. Other raises from the 1850 and 1900-ft. levels and cross-cuts from the former level have exposed large bodies of ore that can



be treated profitably by flotation, and a large quantity of good flotation ore has been blocked out between the 1400 and 1750-ft. levels. The flattening of the main vein below the 1750-ft. level entails much more work at deeper levels than was counted upon when the vertical winze was sunk from the 1750 to the 1900-ft. level, a short distance west of the foot-wall. Flotation tests on Atlanta ore, which carries gold, silver, and copper, have given satisfactory results; but the scheme to have this ore treated in the Goldfield Consolidated flotation plant was abandoned because of difference in character of the ore from that of the Consolidated, that would necessitate separate treatment, also owing to the lack of a market for flotation concentrate. The Merger shaft, through which the Atlanta is worked, is less than two miles from the mill, with standard-gauge rail connection.

High-grade ore is being broken in the southern part of the Kewanas property. A winze was started from the 840-ft. level here over a year ago by the Jumbo Junior company, then working this ground under lease, and a carload of $85 ore was extracted and shipped. Subsequently the lease was forfeited when the Jumbo Junior was no longer able to work through the Velvet shaft of the Jumbo Extension. Sinking the winze was resumed lately, and at a depth of 100 ft. a drift is being advanced, showing 3 ft. of $100 ore. Development work in the northern part of the property on the 840-ft. level exposed pay-ore at a number of points, one 5-ft. face sampling $65 per ton; and the long north drift, with a number of short cross-cuts, gave promise of a large tonnage of flotation ore. In the northern area the trend of the ore on the dip of the shale is toward the adjoining Grandma Consolidated property, where work has been started in the contact-zone from the new shaft.

The Cracker Jack company has resumed work on the 320-ft. level, at a point where an ore-channel was opened for a length of 150 ft. and some $20 ore found. In addition to this the company has started to develop a 40-acre block covering a part of the Consolidated and Florence ore-channel, where approximately $800,000 worth of high-grade ore was mined below the 450-ft. level. Above this depth the ground has remained untouched owing to the absence of mining facilities; but it is now accessible through one of the best equipped shafts in the district. Good ore is said to have been left in the old stopes, extending to the 450-ft. level, when the leases expired. The Cracker Jack Co. has secured a five-year lease on this ground.

Ore found in the east vein of the Cracker Jack, on the 320-ft. level, contains gold, silver, copper, lead, zinc, and bismuth.

Sinking is in progress on the Silver Pick Consolidated from the 1260-ft. level, and a station will be cut at a depth of about 1320 ft. The shaft penetrated a zone of quartz, containing seams of gold-silver-copper ore and some widely-disseminated molybdenite. Local mining men and engineers regard the prospects in this ground as more favorable than before.

In the Grandma Consolidated drifts are progressing north and south from the shaft on the 815-ft. level, in the shale-contact zone. A cross-cut east from the south drift has reached the shaft foot-wall in quartz that is heavy with iron and contains small quantities of gold, silver, and copper.

The Booth property is not being worked, and the rise in its shares is explained by the fact that it owns 250,000 shares of Kewanas and 750,000 shares of Merger Mines stock, received in settlement of its claim of apex rights.

Ore assaying $20 per ton is coming from stopes in the Great Bend mine, above the 160-ft. level; and raises are being driven from the new 370-ft. level to prospect for the ore-shoots opened on upper levels.

J. B. Kendall, manager of the Red Hill Florence, reports good progress in opening the property on the new 600-ft. level where one vein has been cut, and the east cross-cut is being advanced to reach the Rogers vein, which has yielded high-grade ore on the 500-ft. level. Ore assaying from $15 to $50 per ton is being taken from the 450 and 500-ft. levels and shipped to smelter. The shaft is 800 ft. deep and was re-timbered lately from the 500 to the 600-ft. level.

A narrow vein in the Pig claim of the Blue Bull group, opened by a raise from the 250-ft. level, is producing high-grade gold ore; a shipment from this vein assayed $117 per ton.

Lessees on the C. O. D. Consolidated, working through the Gold Bar shaft, have made several shipments from ore-bodies opened at the 150 and 200-ft. levels. These are distinct orebodies, the first containing only gold, the deeper ore carrying gold, silver, and copper.

Two leases on the Jumbo Extension are producing ore of good grade, but work on company account has been discontinued.

ALASKA

Juneau.—Alaska Gastineau reports as under for the third quarter of 1918, comparison being made with the previous period:

	Third quarter	Second quarter
Ore treated, tons	218,930	309,249
Value per ton	$1.323	$1.164
Tailing value	0.230	0.210
Recovery, per cent	82.39	81.96
Operating cost, per ton	$1.148	$0.998
Loss, per ton	0.055	0.046
Total loss	$11,984	$14,248

Every possible economy is being practised, but the officials are unable to operate profitably; and there seems to be little reason to hope for or expect anything approaching satisfactory results as long as present conditions continue.

In the stopes there is estimated to be 1,832,910 tons of broken ore. A re-survey of the stopes is expected to increase this total considerably. On account of the heavy drawing of ore from the upper levels, a slow crushing movement was taking place, so the upper part of the mine will be abandoned. The remaining ore may be drawn from chutes on No. 9 and 10 levels east. With 150 more men the mine could supply the mill at full capacity. The plant worked only 8 hours daily. There was an average of 359 men employed, a decrease of 65 for the quarter.

ARIZONA

Bisbee.—Copper production of Arizona in 1918, according to J. E. Curry, secretary of the Arizona Chapter of the American Mining Congress, is estimated at 819,000,000 lb., compared with 700,000,000 lb. in 1917.

Jerome.—Connection has been made between the portal end of the United Verde Extension tunnel and the Texas shaft. There still remains 1900 ft. of ground between the west heading from the Texas shaft and the mine heading. Progress is slow on account of heavy ground and water.

Kingman.—It is reported that operations are to be renewed at the Catherine mines at Pyramid. The old mill has been wrecked, but it is proposed to re-build when development warrants it.

Mayer.—The Kay Copper Co. is sinking from 500 to 650 ft. On the 500-ft. level the main south-east cross-cut is in 13% ore, the 53 ft. opened averaging 4%. A north cross-cut is in 6% ore for 46 ft. A new compressor has been erected at the main shaft, while at the Buckeye, 2000 ft. north, a new hoist has been put in, preparatory to extensive development.

The Arizona Binghampton Copper Co. has increased its capital from 340,000 shares, $5 par, to 2,000,000 shares, $1 par. This will give sufficient capital to pay for sinking the new 3-compartment shaft 1200 ft., enlarging the present flotation mill, and perhaps building an aerial tram from the mine to the Humboldt smelter, a distance of a little over 5 miles. The present workings are on 100-ft. levels to a depth of 600 ft. The output of the mine is now 175 tons daily, producing from 25 to 30 tons of concentrate.

Sinking is to be resumed by the Western Copper Co. at a 30-ft. shaft on the Patton ground, south of the Binghampton mine. A strong copper vein is being followed.

The Big Bug Copper Co. has moved a gasoline hoist from one of its properties north of the Blue Bell to a shaft on eight claims at Copper mountain. Sinking is to be resumed next month.

Ore found in a drift in the Little Egypt, half a mile east of Mayer, is widening. A steam hoist has been erected and sinking is to be started at the 100-ft. shaft.

Oatman.—Ore from the Carter mine is being hauled to the United Eastern mill for treatment. The ore is said to assay $27 gold per ton.

It is announced that the Tom Reed Gold Mining Co. has paid a dividend of 2%. This is equal to $18,190 on the 909,555 shares issued.

Tucson.—The Blue Bird Mining Co., which has been operating in the Copper Creek district for the past three months, has ceased operations and is removing the machinery.

James H. Emery has filed suit in the Superior Court to foreclose on a mortgage for $25,000 held on the Emery-Whitcomb Tungsten Co. and the National Tungsten Co. The properties are at Las Guijas.

CALIFORNIA

Coram.—The Balaklala company may extend its aerial tram two miles west from the mine.

Jamestown.—A circular sent out by G. H. Egling at Chinese Camp states that the Calaveras and Tuolumne County Chrome Miners' Association was formed on November 23 by a number of men interested in chrome mining for the purpose of fostering their interests which have

CHROMITE IS MINED NEAR ALL THE PLACES MARKED HEREON, SAVE AT JACKSON.

been seriously threatened by the close of the War and consequent lack of market. A resolution was adopted appointing an executive committee for the purpose of framing and presenting a memorial to local Congressmen and Senators to use their efforts in bringing about relief to this essential industry, and restore the market for chrome and prevent financial loss and ruin to the membership of the Association. B. A. Ogden is chairman, with C. E. Shafer, G. A. Richards, and John Madrid as trustees.

San Francisco.—The California State Mining Bureau has issued Bulletin 83, 'California Mineral Production for 1917', of 179 pages, including county maps. The work was compiled by W. W. Bradley, the Bureau mining statistician. The general make-up of the publication is as heretofore. The various minerals and metals are discussed in 114 pages, while producing counties, with tables, receive 32 pages. The total mineral output in 1917 was valued at $161,202,962, a gain of $33,301,352 over that of 1916. Of this increase, $29,554,875 was due to the enhanced price of oil, which was just under $87,000,000. Copper fell off over 7,000,000 lb., gold $1,323,237, and zinc over 4,000,000 lb. Borax gained 6400 tons, chromite 3400 tons, lead 4600 tons, magnesite 55,000 tons, molybdenite 235 tons, potash 111,000 tons, quicksilver 3000 flasks, and strontium 2793 tons. The general statistics are interesting and cover a number of years. County yields of certain minerals are also tabulated. All Californian miners should secure a copy of this bulletin, as it contains a good deal of useful information.

IDAHO

Kellogg.—The Bunker Hill & Sullivan smelter is being enlarged. The furnace building is being extended 72 ft., to allow erection of two blast-furnaces. Three Dwight-Lloyd sintering-machines have been erected recently, and two more are to be put up, making nine in all. The blower-house has recently been doubled in size, and a Connersville blower of 15,000 cu. ft. capacity installed in the extension. A new compressor-room has been completed and a Sullivan two-stage machine of 1100 cu. ft. capacity erected. In the blower-house a Laidlaw-Dunn-Gordon compressor is being installed, to be used as an auxiliary. According to W. K. Mallette, constructing engineer, the most important construction during the last month is the extension to the lead refinery. This is being enlarged by the addition of 72 ft. on the west side of the original refinery. The retorts were removed from the silver refinery and are temporarily in the lead refinery. A new softening-furnace has been built west of the original No. 2 softener, and two additional desilverizing kettles are to be added. Two new cupelling furnaces have been built in the silver refinery in the space formerly occupied by the retorts. These cupels are much larger than the original double furnace, and have added materially to the capacity of this department. In the furnace building a second traveling crane is to be erected, so that one may be used for the refinery.

Wallace.—Consolidated Interstate-Callahan reports as follows for the third quarter of 1918:

Out of the net value of shipments, $269,858, the profit was $49,128. Costs were high, totaling $8.068 per ton of shipping product at rail, due to $100,309 being spent on development and repairs to the mill; $10,000 per month is also set aside for taxes. These expenditures added 40,000 tons to the mines reserves and increased recovery to 92%. No ore was mined during the period. The mill dressed 42,661 tons of tailing, yielding concentrate carrying 8,117,806 lb. of zinc. Underground work proved very satisfactory. On No. 9 level a continuous ore-shoot of high-grade zinc ore has been opened for 255 ft. On No. 6 level of the Interstate, the cross-cut to open ore in the Nipsic property, cut the vein where it was from 1½ to 3 ft. wide, assaying 25.8% lead and 7.7 oz. of silver, with no zinc. This ore is 1000 ft. below the orebody opened in the upper workings, and a large deposit is expected to be developed.

Control of the Chicago-Boston company has been optioned to J. A. Percival of the Interstate-Callahan. The property has been considered out of the productive belt. Up to 1916 some work was done on a small copper vein. Since then a large lead-silver vein was found, and considerable work done. The Day interests then secured control, and sunk a shaft and opened good ore; but as an extension of the option was not granted they gave it up late in 1917. The new owners will probably deepen the shaft.

MICHIGAN

Houghton.—The Mayflower and Old Colony shaft work continues slowly. There can be no expectation of speed at this property, as the management pays just the regular rate of wages, and it is difficult to obtain labor at an isolated shaft such as is being sunk for exploration of these two properties. It is doubtful whether any exploration shaft put down in this district ever went down at so small an outlay as this one. The underground force sometimes consists of a shift-boss and eight men; sometimes the boss and one man. That depends upon agricultural conditions in the immediate vicinity of the mine. The only course of underground labor is from the farmers who reside on land owned by the mining corporations, and leased by the Finnish farmers from the companies. When these men are not engaged in farming they go underground.

The Seneca shaft is 1600 ft. deep, and going down rapidly. Ten jack-hammers are at work in the bottom. Great interest is being taken in operations for the next few weeks, as the vein ought to be cut by Christmas, if not before. It is calculated that the foot-wall of the Kearsarge lode will be cut at 1730 ft., including the angle.

Winona's new flotation plant will dress 600 tons daily. The machinery is on the way, and the concrete foundations are now in place.

MISSOURI

Joplin.—Production of the Tri-State region last week was as under:

State	Blende tons	Calamine tons	Lead tons	Value
Kansas	394	...	88	$30,160
Missouri	731	253	330	75,451
Oklahoma	2,200	...	575	178,500

Average prices were $52 for blende, $38 for calamine, and $100 for lead.

MONTANA

Anaconda.—The new smoke-stack at the Washoe Reduction Works, 585 ft. high, was completed last week.

Butte.—Davis-Daly's report for the third quarter of the current year shows a profit of $110,466. Receipts were $412,444, and disbursements $301,978. Development covered 2449 ft., costing $87,532. This is an important item, as it is opening new ground, improving ventilation, and proving the apex controversy. The output was 17,697 tons of ore, yielding 2,071,886 lb. of copper and 101,705 oz. of silver.

Twin Bridges.—The Potomac Copper Mining Co. has been organized by N. J. Bielenberg and W. J. Higgins to develop a mine near this place. Among the directors are officials of the Tuolumne Mining Co. of Butte. The capital is $1,500,000.

NEVADA

Goldfield.—Tolicha, near Quartz mountain, 50 miles south of Goldfield, is being revived by E. A. Ludwig and others of this place. Some $30 gold-silver ore is said to be exposed. There was a boom at Tolicha in July of last year.

Pioche.—A considerable amount of surface and underground work has been accomplished during recent months at the Virginia-Louise. A 1000-ft. railroad spur now connects with the Prince Consolidated line, making it possible to ship ore direct at the mine. An inclined ground tramway now connects the receiving-bin at the shaft with the 100-ton bin at the railways. Houses have been erected, also toolshop and sampling-plant. Ore-pockets have been excavated on three levels, and considerable work done underground. So far, 95 cars of ore have been sent to Utah smelters.

Rochester.—The Nevada Packard reports that the contact fault, recently prospected to some extent, is a single orebody which may be mined from the surface for a distance of 1600 ft. It is from 10 to 12 ft. wide, and car-samples for six days averaged $14 per ton. The report for October showed treatment of 2723 tons yielding bullion worth $21,785, with a net profit of $8122, or $2.98 per ton.

NEW MEXICO

Fort Hancock.—At the copper mine of A. Kraft, 12 miles from there and just over the Texas line, a 100-ton gravity concentrating and flotation mill is being built. The ore averages 3%. For two years 5% sulphides and carbonates have been sent to El Paso.

OKLAHOMA

Cardin.—The Oklahoma Ore Storage Association has let a contract for erecting a warehouse of 50,000 tons capacity, similar to that at Douthat.

Douthat.—The Oklahoma Ore Storage Association has started to erect a warehouse here. It will be 400 ft. long and 50 ft. wide, with a capacity of 50,000 tons of concentrate. This is No. 2 of the series to be built in the State.

Picher.—The first of the Oklahoma Ore Storage Association's warehouses is receiving concentrate. Its capacity is 60,000 tons. It is equipped with machinery for handling the product.

Production of the mining districts last week was 2200 tons of blende and 575 tons of lead, valued at $178,500.

OREGON

Gold Hill.—Mining is expected to improve in this district. During 1914 a score of gold mines within a radius of six miles of this place, equipped with 5 to 20-stamp mills and having large quantities of ore available, suspended work. Most of the operators took up the mining of chrome, copper, manganese, and quicksilver on the basis of war prices. Many of them will now probably resume gold mining.

An important suit was recently started in Josephine county by Harry Kelly, involving $200,000, against R. J. Rowen and the California Chrome Co. The complaint alleges that during Kelly's absence in California his interests in valuable chrome properties in the Waldo district, which have since produced 4000 tons of chrome and sold to the California Chrome Co. at $50 per ton, were conveyed to R. J. Rowen and others. Kelly alleges that the deed was a forgery, and the notary public, a local official, whose name and seal appears on the document, says that he never saw Kelly and never took any such acknowledgment.

A carload of machinery from California is being erected on the Copper Lode mine near Buncom, in the upper Applegate district. The owners are Charles Lillie of Los Angeles, and W. N. Campbell, F. C. Clark, and E. W. Liljegram of Medford, Oregon. The vein is 5 ft. wide at a depth of 35 feet.

SOUTH DAKOTA

Deadwood.—The Cutting Mining Co. is making extensive plans for continuing development started over a year ago. Several good veins have been opened by tunnels, and work has now started on sinking a shaft. A two-compartment one will be sunk to 500 ft., and the orebodies further explored at depth. The shaft-house is under construction and an electrically-driven compressor and hoist have been purchased, to be installed before 1919. The property adjoins the Homestake on the west, and with the present showing, should be a producer within another year.

Shaft-sinking continues at the Echo property at Maitland, it now being over 100 ft. deep. This will be continued to 300 ft., followed by lateral work. Lead-silver ore is being developed.

Lead.—The State geologist, Freeman Ward, has just issued a bulletin on the 'Possibilities of Oil and Gas in Harding County, South Dakota.' In summarizing his findings, Mr. Ward says: "It is believed that there is a reasonable chance of striking gas (and possibly oil) in the county. The most favorable places for putting down holes are on the Glendive anticline and the smaller anticlines in the adjoining areas, one of which has already been located." Harding county is in the north-western part of the State, and the greater part of the area is underlain by deposits of lignite. The possibilities of finding oil and gas will no doubt lead to the drilling of wells. In addition to this county there are oil indications in Fall River county in the vicinity of Ardmore. Drilling has been done there for some time, but as yet the holes have not gained a sufficient depth to prove the field.

TEXAS

Matagorda.—It is stated that J. T. Robison, State Land Commissioner, who has just returned from the property of the Texas Gulf Sulphur Co., situated on the coast, near this place, that the prospect holes went through a solid deposit of sulphur 122 ft. thick. The product analyzed 98% S. The company has expended up to this time more than $1,500,000 on equipment.

UTAH

Alta.—The Michigan-Utah is to extend its aerial tram in time for next season's ore movement. This tram has been operated for some years, carrying ore from the mine to Tanner's flat, a distance of 4½ miles. Its capacity is 100 tons, while the length will be added to by 3½ miles to Wasatch on the Salt Lake and Alta Railroad. The ore contains lead and silver.

American Fork.—The American Consolidated Mines Co., which operates the Earl Eagle and Bog mines, has the tunnel at the former in over 2000 ft. High-grade copper stringers are coming into the face. At the Bog the tunnel is in 600 ft., and the orebody opened above is expected to be cut soon. One shipment assayed 13.81% silver, 80 cents gold, and 8.1% lead.

Cisco.—According to James McWilliams, a well-known prospector, the La Sal district in Grand county, 38 miles south of Cisco, is worthy of exploration. The ores carry copper, gold, and silver, and some uranium.

Cove Fort.—The Utah Sulphur Co., operating in Beaver county, and controlled by M. P. Morrissey, expects to start its new plant about mid-December. It has a capacity of 75 tons of sulphur daily. A great deal of preparatory work has been done this year, in a district inactive for many years.

Eureka.—The Centennial-Eureka company will probably follow the good ore opened at 1900 ft., to below water-level. A winze is already down 40 ft., where water was reached.

Park City.—The Thayne Canyon mill of the Silver King Consolidated is concentrating ore from No. 2 shaft, where a large tonnage is available between 200 and 300 ft. The plant dresses 150 tons of lead-silver-zinc-gold ore daily.

CANADA

British Columbia

Atlin.—Development of the Alexander mine, reputed to be a rich free-milling gold property, is likely to be retarded as a result of the death of its owner, James Alexander, who with his wife was drowned when the steamer 'Sophia' foundered in Lynn canal a short time ago. Who owns the Alexander? That is the question which has been raised since the disaster. Some litigation might result. No will has been found, and A. J. Smith of Philadelphia claims that he is heir to the estate, as he advanced considerable sums of money to Alexander while developing the mine. M. B. Fairlie, manager of the Mining Corporation of Canada, operating at Cobalt, Ontario, and F. G. Stevens, an engineer with the same company, recently inspected the Engineer mine.

Kaslo.—A survey of the manganese deposits of this district has been issued by the Mines Department at Ottawa. Three claims—the Harp, Collingwood, and Black Diamond—are 5 miles from town at 2690 ft. elevation, on the northeast side of the valley of Kaslo creek. The secondary deposits of manganese occurring on the valley terraces and slopes flanking the Kaslo volcanic area of the Blue Ridge are the most noteworthy yet discovered in British Columbia. The ore consists of different forms of wad or bog manganese. A sample of this material proved to be a good grade of wad, containing 48.14% of manganese and 1.65% iron.

Sandon.—The Silversmith Mines' new mill that started work early in October, yielded lead-silver and zinc concentrates worth $82,000. Some crude ore was also dispatched. The profit was $62,000 for the past two months.

Trail—Consolidated M. & S. Co. pays a dividend of 2½% on January 2. This makes 10% for the year.

Obituary

Pierre de Puyster Ricketts died on November 20 at his home in New York. He was just 70 years old. For 32 years he was identified with the Columbia School of Mines as professor of chemistry and assaying. He resigned in 1900 in order to engage in consulting practice under the firm name of Ricketts & Banks. In 1876 he published a textbook entitled 'Notes on Assaying'.

Harry P. Corliss, chemical and metallurgical engineer with the Metals Recovery Co., died on November 16 at the age of 32 years, at Ray, Arizona. His death was the result of pneumonia following influenza. In 1910 Dr. Corliss received the degree of Bachelor of Science in chemical engineering from the New Hampshire State College. He then continued his studies at the University of Toronto for two years, specializing in physical and organic chemistry. At the end of that time he accepted a position as Industrial Fellow in the Mellon Institute of Industrial Research, at Pittsburgh, Pennsylvania. In 1913 he received the degree of Doctor of Philosophy from the University of Pittsburgh. His work at the Mellon Institute extended over a period of five years. During most of this time he was engaged in research upon metallurgical problems. The research resulted in several important improvements upon the flotation process for the recovery of minerals. Perhaps his most notable contribution to this industry was his discovery of alphanaphthylamine as a flotation agent. It is too early as yet to estimate the full value of this discovery to the metallurgical world, but the results already obtained justify the belief that Dr. Corliss' work will one day be recognized as of the first importance in this field. In 1917 he accepted a position with the Metals Recovery Co. in order to initiate the large-scale application of his discoveries. In this work he was uniformly successful and was rapidly making for himself an enviable reputation as a metallurgical engineer when death called him.—C. L. P.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

F. L. Cole is at Washington.

H. Hardy Smith has arrived in London from Korea.

B. Read, recently in the Army, has returned to Oakland.

C. H. Munro has returned to San Francisco from New York.

W. H. Seamon is now manager of the Richmond basin group of mines near Globe, Arizona.

B. M. Snyder has returned from Pearce, Arizona, and is at Los Angeles, with offices at 219 Security building.

Arthur J. Hoskin has returned to Denver from Montana, where he completed the erection of an oil-shale plant.

H. W. Faulkner, superintendent of the Pacific Coast Borax Co.'s mines at Ryan, was in San Francisco this week.

J. C. Scales has established a branch office at Salt Lake City for the Mines Efficiency Co. of Duluth, Minnesota.

Joseph P. Hodgson succeeds **M. H. McLean** as general manager of the Morenci branch of the Phelps Dodge Corporation.

A. L. Larsen, until recently draftsman for the Consolidated Mining & Smelting Co. at Trail, B. C., is leaving for San Francisco, California.

H. E. Eye, manager of the Sasco plant of the A. S. & R. Co., has been placed in charge of the same company's smelter at Hayden, also in Arizona.

S. G. Blaylock, assistant general manager for the Consolidated Mining & Smelting Co. of Canada, has returned from a business trip to the East.

Norman Carmichael, manager for the Arizona Copper Co. at Clifton, has been elected governor of the Arizona Chapter of the American Mining Congress.

A. S. Wheler has been invalided out of the British Army after 18 months service with the 170th Tunnelling Company. He expects to go to China shortly.

C. F. Dyke, manager and part owner of the Montreal mine at Douthat, Oklahoma, has been chosen to be the head of the Tri-State Safety and Sanitation Association for the coming year.

W. B. Thompson has resigned from the presidency of the Inspiration Consolidated Copper Co. and is succeeded by **C. F. Kelley**, the president of the Anaconda Copper Mining Company.

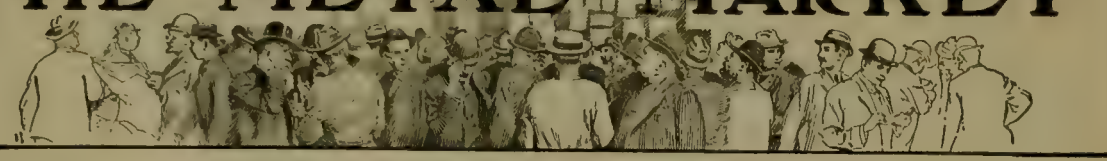
Louis D. Ricketts addressed the local section of the A. I. M. E. on December 10 and gave a deeply interesting description of operations at the Inspiration and New Cornelia mines illustrated by a cinema-film.

O. Wiser has resigned his position as assistant superintendent of mills for the Chino Copper Co., at Hurley, New Mexico, to assume the active management of the Republic Mining & Milling Co., at Hanover, New Mexico.

Leslie Urquhart has been appointed British Agent for Supplies to the people of Siberia. This is a relief measure. Three ship-loads of boots, clothing, cotton goods, and other first necessaries have started. Others are to follow. **J. P. B. Webster** sailed on the 'Ecuador' on the 10th to represent him in Siberia.

E. Gybbon Spilsbury has been appointed to represent the American Institute of Mining Engineers at the Engineering Congress in Paris. The delegation from the United States, invited by the French government, is composed of members of the four national engineering societies. The delegation sailed on December 5 and expects to be away about six weeks.

THE METAL MARKET



METAL PRICES

San Francisco, December 10

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	10.00
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	7.30— 7.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$120
Spelter, cents per pound	10.50
Zinc-dust, cents per pound	16.00

ORE PRICES

December 10

Chrome, no definite quotations available.

Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton ..... $22—$30

Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29) ..... $0.86—$1.30

Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29) ..... $1.01—$1.45

(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)

Molybdenite, per lb., 90% MoS_2 ..... $0.75—$1.00

Pyrite, per unit of sulphur, cents ..... 28—32

Tungsten, 60% WO_3, per unit ..... $17—$23

The South Dakota School of Mines at Rapid City has just issued Bulletin No. 12 of 264 pages, entitled 'The Occurrence, Chemistry, Metallurgy, and Uses of Tungsten', by J. J. Runner and M. L. Hartmann. This is probably the most complete work on the mineral, and may be secured by writing to the address given.

EASTERN METAL MARKET

(By wire from New York)

December 10.—Copper is unchanged. Lead is quiet and easy; re-sale metal is 6.75c. Spelter is dull though steady.

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government fixed its maximum at 49½ pence, on September 2, but on November 12 this was changed to 48¾ pence, due to a drop in price.

Date	New York.	London	Average week ending	
Dec. 4	101.12	48.75	Oct. 29	101.12
" 5	101.12	48.75	Nov. 4	101.12
" 6	101.12	48.75	" 12	101.12
" 7	101.12	48.75	" 19	101.12
" 8 Sunday			" 26	101.12
" 9	101.12	48.75	Dec. 3	101.12
" 10	101.12	48.75	" 10	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	101.12
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

Reduced rates of war risk insurance caused a fall in the London price. After remaining no less than 71 successive working days at 49½, the quotation fell ¾ d. on the 12th to 48¾ d. The official maximum has been fixed by the British Treasury at this figure, according to Samuel Montagu & Co. The Shanghai exchange rate is easier. The Indian currency returns show a substantial advance in the holding of silver. On the 7th the total, 3109 lacs ($99,488,000), was the highest since December 15, 1915, when 3114 lacs were recorded. The note issue, however, has more than doubled since that date.

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin. On December 3 the War Industries Board fixed the price to consumers and jobbers at 72½c. f.o.b. Chicago and Eastern points, and 71¼c. on the Pacific Coast.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	78.82
May	49.10	63.21	100.01	Nov.	44.12	74.18	73.67
June	42.07	61.93	91.00	Dec.	42.55	85.00	....

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date		Average week ending	
Dec. 4	26.00	Oct. 29	26.00
" 5	26.00	Nov. 4	26.00
" 6	26.00	" 12	26.00
" 7	26.00	" 19	26.00
" 8 Sunday		" 26	26.00
" 9	26.00	Dec. 3	26.00
" 10	26.00	" 10	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.69	23.50	Nov.	31.95	23.50	26.00
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York. This was reduced to 7.05c. on December 2.

Date		Average week ending	
Dec. 4	7.05	Oct. 29	8.05
" 5	7.05	Nov. 4	8.05
" 6	7.05	" 12	8.05
" 7	7.05	" 19	8.05
" 8 Sunday		" 26	8.05
" 9	7.05	Dec. 3	7.85
" 10	7.05	" 10	7.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	8.05
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Dec. 4	7.65	Oct. 29	9.04
" 5	7.60	Nov. 4	8.96
" 6	7.60	" 12	8.91
" 7	7.60	" 19	8.62
" 8 Sunday		" 26	8.61
" 9	7.60	Dec. 3	8.67
" 10	7.60	" 10	7.61

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.57
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16.01	9.41	7.29	Nov.	11.81	7.76	8.75
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

The price scheduled for second-grade concentrate in the Tri-State region of Missouri-Oklahoma-Kansas is 'off'. Producers found that only 50% of the smelters could be 'lined-up', while the former could get 72% together.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government is taking 40% of the United States quicksilver output, paying therefore $105 per flask. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date			
Nov. 13	120.00	Nov. 26	120.00
" 19	120.00	Dec. 3	120.00
		" 10	120.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110.00	Nov.	79.50	102.50	120.00
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

The Cassel Cyanide Co. of Glasgow, Scotland, pays a dividend of two shillings (24 cents) per share on December 23. This is equal to £70,500 ($336,000) and makes £105,750 ($508,000) for the year. This is at the rate of 60%.

Eastern Metal Market

New York, December 4.

The markets are still largely controlled, though each week brings indications of relaxation that will develop into free markets.

Copper will continue unchanged probably until January 1.

Tin is under control with the fixed prices announced on the third.

The maximum price of lead has been decidedly reduced.

Zinc is dull, but steady and firm.

Antimony is unchanged.

The trend of events seems to point to a free market in pig-iron and steel after January 1. Sentiment in favor of continuing Government control of prices of these after December 31 has steadily diminished. A conference between steel-makers and the War Industries Board on the 11th will probably result in an end to price-fixing. Buying to satisfy long-restrained wants finds the steel trade skeptical of the ability of such demand to cope with the situation soon to be met. The country's steel mills are still engaged on war work to a large extent. Actual export business put through is not large, though inquiry is ample. British export prices are $15 to $20 per ton above official prices here for heavy products. Prices so far realized here in small export orders are higher than the fixed maximum domestic prices, but are lower than the British.

Pig-iron output in November again declined; it was 3,354,074 tons, or 111,802 tons per day, compared with 3,486,941 tons in October, or 112,482 tons per day.

COPPER

Opinion in the trade leans to the probability that an open market will prevail after January 1, until which time the price is fixed at 26c. This may not turn out to be the case. There are many factors affecting a decision, prominent among which is that of labor's compensation. The matter will probably be decided in the next week or two. Consumers are not making inquiries until the situation is cleared up. Considerable has been heard about cancellations, but it develops that no such thing is recognized by copper producers, a sale being a sale for all time. This factor has therefore not entered into the situation. So far as re-sale of electrolytic or Lake copper are concerned, such metal was sold to consumers with the understanding that it was to be used by said consumers and not to be re-sold at any price. It is probable there has been little if any such re-selling. Casting copper continues to decline and is now quoted at 23 to 23.50c. per lb. It is made largely from scrap copper, which is now plentiful.

TIN

The long-expected announcement of a fixed price for tin, brought under international control, has at last been made. It came out on Tuesday, the 3rd. According to this announcement, which comes from the War Industries Board, the U. S. Steel Products Co. is authorized to offer pig-tin, allocated by the Inter-Allied Tin Executive to that company for distribution at cost to consumers, jobbers, and dealers in the United States holding purchase licenses from the Board, at 72.50c. per lb., ex-dock or port of New York or Chicago, or f.o.b. delivery points at Chicago and points East; and at 71.25c. per lb. ex-dock or store Pacific ports, both at sellers' option. These prices are for shipment in the months of December and January, sales being confined to lots of 25 long tons and over in one purchase. Consumers, dealers, and jobbers may purchase in lots of not less than 25 tons. Dealers may re-sell in lots of 5 tons and over to consumers and jobbers holding purchase licenses from the Board, at a gross profit not exceeding 2½%, whereas in the case of jobbers such re-sales may be made at a profit not to exceed 5%. The regulations prohibiting the sale of tin by consumers are to be strictly enforced. Only Straits and Australian tin have been allowed. Up to today re-sale lots of tin have been sold down to 70.50c. per lb., New York, for prompt shipment. An interesting fact is that Australian tin was offered in the last week at 63c., San Francisco, but its importation is prohibited except by the United States Steel Products Co. The November arrivals of tin were the lowest in months at only 2300 gross tons, of which 2245 tons came through Pacific ports. Average deliveries in the 10 previous months has been 5191 tons per month.

LEAD

The totally unexpected has happened: On Monday, December 2, the Lead Producers' Committee announced a drastic cut in the agreed price of lead, of 1c. per lb. The quotation now stands at 6.75c., St. Louis, or 7.05c., New York. It had been supposed that supplies were small and that the market would advance rather than otherwise, especially if left to itself. Last week the London market for lead was made an open one, and at once the price advanced £11 per ton. Possibly there have been cancellations of Government contracts, rendering the supply larger. The control of this market being a voluntary one and not by Government mandate, makes this reduction all the more significant. In the opinion of some, it foreshadows lower copper prices. New business in lead is light.

ZINC

The market is quiet but steady. Demand is not quite as heavy as recently, but it continues fair, largely from galvanizers. The quotation for prime Western for early or December delivery is 8.25c., St. Louis, or 8.60c., New York, with prompt held at 8.40c., St. Louis, or 8.75c., New York. The quotation for first quarter is about 8c., St. Louis, or 8.35c., New York. One dealer quotes 8.12½c., St. Louis, for prime Western for December delivery. The weekly Government report of stocks and output for the week ended November 23 shows each to have increased a little more than 600 tons.

ANTIMONY

The market is quiet at 8.50 to 8.75c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

Government maximum prices continue unchanged for No. 1 virgin metal and for scrap at 33c. per lb. for 50-ton lots, 33.10c., per lb. for 15 to 50-ton lots, and 33-20c. per lb. for 1 to 15-ton lots. It is understood that more material is available for domestic uses.

ORES

Tungsten: There has been no change. Stabilizing the market is being considered at Atlantic City by a committee of the industry in conference with Van H. Manning, director of the U. S. Bureau of Mines. High-grade ores are quoted nominally at $21 to $23 per unit, with the low grades from $17 to $18. The ferro-tungsten market has not been tested recently.

Molybdenite: The market is dull, and prices are nominal at 75c. to $1 per lb. of 90% material. A sale of 80% concentrate is reported at 87½c. per pound.

Manganses Alloys: Re-sale ferro has appeared at $240 per ton, delivered, while spiegeleisen up to the 22% grade can be bought at $70, furnace. Demand for both continues insignificant.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

MONORAIL ORE-HAULAGE

*What is said to be the first successful monorail system in the United States is now in experimental operation at the Highland-Surprise mine, on Pine creek, Coeur d'Alene region, Idaho. The trial has caused much local interest, and operators say that the system will completely solve the transportation problems that have been so vexatious in the past. The track as now operated is 1000 ft. long over a 10% grade leading down the creek from above the mill. Equipped with a 20-hp. Ford engine, and loaded with three tons, the car is said to attain a speed of 18 miles an hour on the up-grade. Four or five trailers are attached to each train, giving a total capacity of 12 to 15 tons. The most important feature of the system is the cheapness of construction. Grading is entirely dispensed with, and unevenness in contour is overcome by the height of the posts supporting the track. The cost of upkeep is therefore practically negligible, while 1000 ft. of track can easily be built in a day under ordinary conditions. Grades of from 10 to 15% can be negotiated without difficulty, and the inventor claims that the cost of construction over average Coeur d'Alene mountain routes will run from $3000 to $4000 per mile. The accompanying photograph shows the system fully. Either gasoline or electric power can be used, and it is said that one man can attend to haulage of from 100 to 300 tons per day over a distance of several miles at a low cost. Track may be economically constructed during the winter. Only two sizes of timbers are used, and posts can be made of such lengths as to place track above all possibility of snow troubles. The load is carried on both sides of the car and below the rail. For carrying ore, special side-dumping pockets are provided.

MONORAIL ALONG PINE CREEK, COEUR D'ALENE, IDAHO.

The inventor is W. H. Sheppard, who has resided in Seattle for 18 years and who has devoted the past seven years to perfection of the system. Some time ago he brought his idea to the attention of W. W. Papesh, president of the Highland-Surprise Mining Co., who provided the capital to construct the short track now in operation. The first trials were so satisfactory that the Highland-Surprise has concluded to extend the line to Masonia, the settlement three miles below the mine on the line of the branch road of the O.-W. R. & N. Co., now being constructed up Pine creek.

While monorail systems are in successful use in Europe, no serious attempt has previously been made to apply them to ore transport in mountain regions. The Monorail Transit Co. of Seattle, Washington, makes this plant.

*Excerpt from 'Northwest Mining Truth', Spokane, Washington.

A NEW RESEARCH BUILDING

The Westinghouse Electric & Manufacturing Co.'s new research building at East Pittsburgh, Pennsylvania, is about a mile from the works on the Lincoln highway. Architecturally, the building is plain but substantial, of reinforced concrete and brick, trimmed with white terra-cotta. The distinctive features of the building are its plumbing and wire services, being arranged in such a way as to enable these services to be brought into any particular laboratory when needed without disturbing any other part of the building. The research organization was founded in 1906.

The manufacture of electric machinery and apparatus is one of the most intricate and complicated in industry, and is characterized as being in a state of constant improvement and progress. New problems requiring special research work are continually confronting the engineers. Provision is made in the new building to deal with a large variety of experiments in many lines of work, including magnetic insulation, metallographic metallurgy, organic and inorganic chemistry, furnace combustion, wood-working, illumination, glass-blowing, etc.

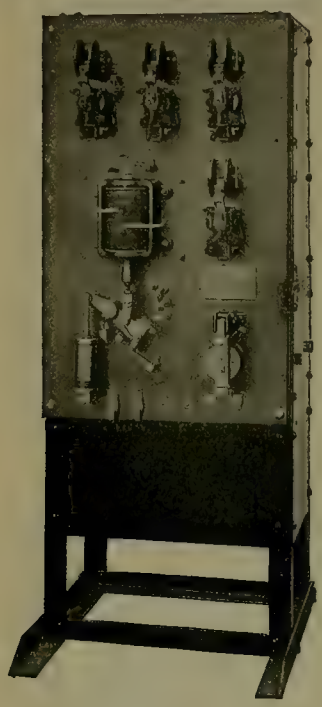
The power-house contains motor-generator sets for one, two, or three-phase currents, an air-compressor, vacuum-pump supplies, liquid-air machine, storage-battery in the basement of the power-house, electric-furnaces of various types, together with the necessary control for melting, annealing, and various metallurgical processes.

MINE-DUTY STARTERS

On account of the injurious effect of moisture in mines, and the severe operating conditions, special care should be used in the selection of motor-starters and controllers, particularly those for ventilating-fans and pump motors, as in most mines these must be kept in continuous operation. Another condition that affects the operation of motor-starters is the wide fluctuations in generator or line-voltage caused by mine hoists and locomotives. For these reasons the standard design of hand or automatic starter will not operate satisfactorily, and a starter should be selected that is especially adapted to operate under such conditions.

The accompanying illustration shows a mine-duty self-starter, manufactured by the Cutler-Hammer Mfg. Co. of Milwaukee. This apparatus has recently been re-designed, and embodies several operating and protective features essential to the continuous operation of a fan or pump motor.

Plain hand-starters and starters without self-resetting features will drop to the 'off' position every time a large drop in voltage occurs; this of course stops the motors controlled by them and serious results may follow. When a motor receives current at a voltage considerably lower than its rated potential it will slow down, and stop when this voltage drops to a certain value or when the current is 'off'. Control apparatus is required that will automatically ensure the continuous running of the pumps and fans, even if at reduced speeds, also to re-start them after a complete interruption and subsequent resumption of current supply.



MAGNETIC SWITCH TYPE OF MINE-DUTY STARTER.

To meet these conditions the starter illustrated, which is a pilot-switch accelerator type of motor up to 100 hp., is fitted with a rugged relay which is very sensitive in its action. This relay guards against injury to the motor; it causes all of the armature resistance to be inserted in case of a bad drop in voltage, thus checking the heavy current resulting from the decreasing counter electro-motive force. If the line-pressure falls to about 80% of the normal the relay drops out, opening the control-circuits to the accelerating switches that drop in turn and cut into circuit the heavy-duty starting resistance, which has capacity for continuous service at low voltage. The motor then runs at slow speed until the voltage increases, and at 90% of normal the relay pulls in again, cutting out the resistance and permitting the motor to accelerate to normal full speed.

A single coil overload, where shunt-wound motors are used, can be added to also insert the armature resistance in case of an overload and thus keep the fan or pump going at a reduced speed. This single-coil overload and the voltage relay prevent the shunt motor from flashing over under severe voltage fluctuations. When the voltage drops to a very low value, the motor tends to run as a generator and is liable to 'flash over' across the brushes, injuring the motor and commutator. With a compound motor the overload is not so necessary, because when the motor tends to run as a generator the compound winding opposes the shunt winding, neutralizing the field and preventing those conditions which result in 'flashing over'.

NOTES ON A 2-TON ELECTRIC-FURNACE

An electric-furnace, whose main product is nichrome, the well-known high-temperature resisting alloy, has recently been erected at the plant of the Driver-Harris Co., Harrison, N. J. The furnace is of special interest because of its electric equipment, which is an excellent example of modern practice. Alloys of various composition are also made in the furnace, which is of the 2-ton Heroult arc type, with automatic regulation.

During a run on 3000 lb. of nichrome and on a high nickel steel the amount of power taken at the start of the heat is small in both cases; but as the resistance of the furnace-circuit decreases, owing to the heating-up of the electrodes and the consolidation of the charge, the power consumption rapidly increases until stable conditions are reached. The average amount of power consumed is then held practically constant by an automatic regulator, with the exception of a slight continuous increase due probably to a corresponding decrease in the resistance of the furnace circuit. There is, however, no uniformity in the actual power consumption. As the charge melts, pieces of metal fall in between the electrodes and establish short circuits. For the most part these short circuits are only momentary, as the fragments causing them are promptly melted, but occasionally they persist and then the automatic regulator draws up the electrodes until they are clear. This process sometimes breaks the arc, and then there is a sudden decrease in the power consumption until the regulator brings the electrodes down again and re-establishes the arc. As would be expected the nickel-steel alloy shows more of these irregularities than the softer nichrome. Toward the end of the run there is a marked change in power consumption, when the metal is given a special treatment before pouring. In the case of the nickel-steel a higher temperature was necessary, perhaps to lower the carbon content, while with nichrome the temperature was lowered. The temperature of the furnace averages 2200° F.

High momentary overloads are characteristic of electric-furnace work, and make it much different from ordinary power service.

At the Driver-Harris plant one of the most interesting features is the Thury regulator, which automatically maintains an approximately constant current at the furnace electrodes. Without this device the current consumption would vary eratically, even if an operator were constantly endeavoring to correct the variations. This apparatus saves labor and current, reduces to a minimum the time required to prepare a charge, and by providing uniform conditions, keeps the quality of the product uniform.

Each furnace electrode has a separate regulating mechanism, and a raising and lowering motor. The regulator can be set for any desired current value and when this value is exceeded, each regulating mechanism closes a contact momentarily which causes the motors to raise the electrodes slightly. The contacts continue to close at brief intervals until the electrodes are drawn up high enough to reduce the current to the pre-determined value, the intermittent action being employed to prevent the electrodes from being raised too high and thus causing an unstable condition. When the current falls below the pre-determined value the electrodes are lowered in a similar manner. The regulator itself is controlled by a solenoid energized by means of current from series transformers in the main high-tension circuit. Damping devices prevent the regulator from acting on overloads that immediately correct themselves. In addition to the automatic device, each electrode motor has a drum controller for manual operation.

When the charge is finished, the whole furnace is tilted bodily for pouring. This tilting is effected by an 11-hp. alternating-current slip-ring motor, working in a pit beneath the furnace and geared to the tilting mechanism. It has a drum controller by the side of the furnace. All of the equipment consists of standard Westinghouse Electric & Mfg. Co.'s furnace apparatus.

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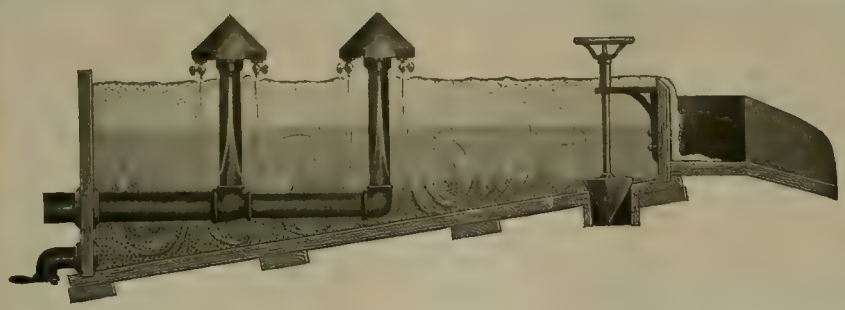

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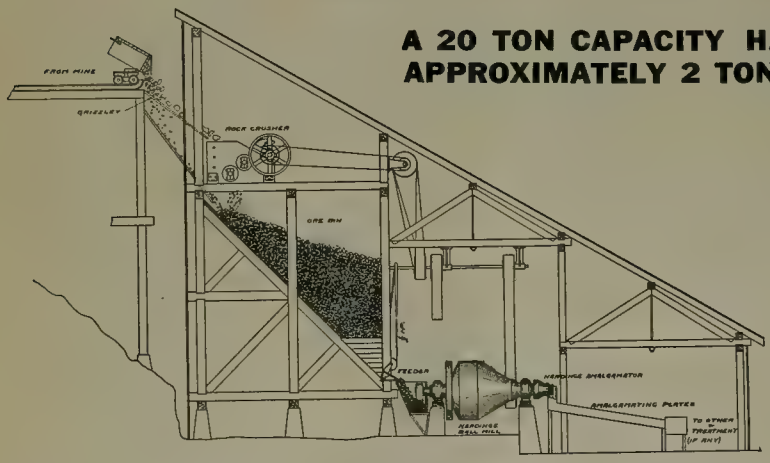

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T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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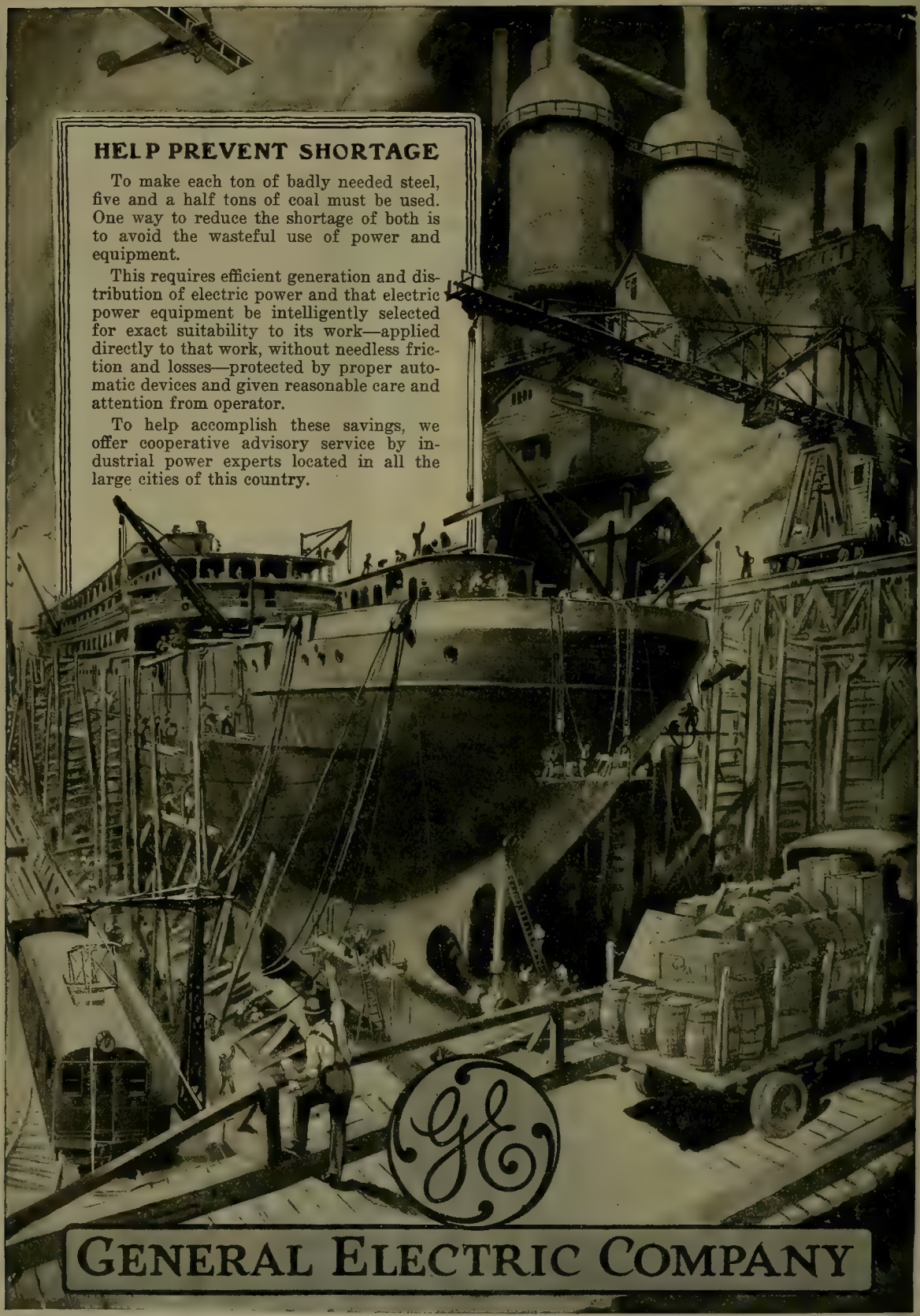
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EDITORIAL

SENATE Joint Resolution 156, for extending the period of exemption work on mining claims, is on the docket of the House of Representatives. It is hoped that it will be passed, but this is doubtful.

EXPANSION of mining in California is indicated by the fact that whereas in 1887 the output of gold from the mines of the State represented three-fourths of the total mineral production, and almost a half in 1907, it constituted only one-eighth the entire production in 1917. Last year 54 different mineral substances were mined and marketed. So says the State Mining Bureau, which is making a sincere and successful effort to aid and stimulate the exploitation of California's mineral resources.

IT is estimated that 300,000—possibly 350,000—persons have died of influenza in the United States, as compared with 260,000 casualties and 36,000 deaths in the War. The loss to the profession from the epidemic is incomparably greater than from the War. We regret deeply to have had to record the untimely ending of many promising careers, notably O. F. Ambur, H. P. Corliss, B. H. Dosenbach, Howard Du Bois, Robert M. Green, Frederick A. Hale, Jr., Howard S. Lee, J. J. Morrison, O. T. Storrs, W. A. B. Walling, C. A. Waring, and C. A. Wheeler.

RIGHTS to the use of water struck in the course of mining work is the subject of a letter from Mr. G. A. Duncan. He touches upon the distinction between 'percolating' and 'flowing' water. On this difficult question the courts have held that water issuing from a mine is not a watercourse and therefore is not subject to the law of appropriation. If, however, it flows in a definite channel underground it becomes subject to the same laws as water that flows in a channel on the surface. The definition of stream-water has been expanded in several cases, as in that of the Los Angeles water-works, in which instance the water was gravitative and was drawn from a channel in the San Fernando valley. If water runs in a definite channel it is not percolating water, which is subterranean water saturating a plane without definite source or channel. At Ely a steady flow of water issues from the limestone; this is unquestionably an underground river. There remains a twilight zone of meaning between 'percolating' and 'flowing'; and on this the courts have yet to adjudicate in special cases.

GERMAN duplicity of a familiar kind is illustrated humorously by the statement of Von Eckhardt, the German minister at Mexico City, in explanation of the decoration of buildings in that city with German flags on November 11. He said that it was done "to show their satisfaction that their country had given peace to the world." By the way, it is noteworthy that William Bayard Hale, the Hearst journalist who was retained, at $15,000 per annum, as a propagandist by the German bureau directed by Dr. Bernhard Dernburg, was sent by President Wilson to investigate conditions in Mexico shortly before the War. One can imagine how he colored his report to suit the policy of his friends at Berlin.

LAST week the local section of the Institute spent a most enjoyable evening, thanks to Dr. L. D. Ricketts, who exhibited and described cinematic films illustrating mining and metallurgical operations by the Inspiration Consolidated and New Cornelia copper companies at Miami and Ajo, respectively. It was amusing to note how the film by its rapid motion gave the illusion of feverish activity on the part of the workmen. In the same way, the speed at which the Marcy mills were made to revolve suggested an expensive, and even dangerous, operation, as compared with the slow and comfortable gait at which these machines actually turn. The big tailing-excavator at Ajo made an impressive picture; when the whole machine, with its trestle and housing, was moving it looked as if the entire plant was being shifted to suit the excavator, instead of the reverse. Dr. Ricketts referred to "the constant error in sampling"—the error made in assuming that ore can be broken on a large scale, by the caving system, for example, as cleanly as in moil-sampling or in churn-drilling. He mentions another interesting point, namely, the fact that part of the 'unaccountable loss' at a smelter is due to 'dusting', so that it has proved advisable to enclose the mixing-beds and to avoid the dropping or other movement of ore in the open air. At the Inspiration 12½ million dollars, including $2,000,000 expended on the International smelter, was spent before the investors

were assured of the success of their enterprise, this fact indicating the enormous capital expenditure required to place a low-grade copper undertaking on its feet. It only remains to add that Dr. Ricketts' kindness in making the exhibit was keenly appreciated, because it involved not only money, which is cheap, but personal inconvenience and trouble, which are dear.

ANACONDA'S position in the world of mining is being steadily aggrandized by its purchase of stock in other large enterprises. In 1915 the Anaconda Copper Mining Company acquired 150,000 shares in the Inspiration Consolidated Copper Company and 30,800 shares in the Greene-Cananea Company. By the end of 1917 its holdings had been increased to 250,900 shares of Inspiration and 56,600 shares of Greene. It is reported that Mr. William B. Thompson's holding of Inspiration stock was sold on the market some time ago; this would explain his resignation of the presidency of the Inspiration company and the election of Mr. C. F. Kelley, who has been acting as president of the Anaconda during Mr. John D. Ryan's devotion to war-work. The aggregate output of copper made by the three companies mentioned amounts to the magnificent total of 420 million pounds per annum. While we are always inclined to regret the extension of control over a multiplicity of enterprises, because efficiency is not increased and moral responsibility is usually decreased after a company's operations have reached beyond the magnitude favorable to economic work, we recognize that the Anaconda management has been marked by an enlightened spirit and that if any company is to be aggrandized in this way then the Anaconda is the one least likely to abuse its power as a controller of industry.

THE suggested fixation of gold at a higher price, as, for example, by the Government paying a bounty on new gold, has been regarded by some of our academic friends as a highly dangerous scheme for correcting an abnormally rapid appreciation of the metal; any tampering with the gold standard has seemed to them an economic vandalism. It is interesting therefore to find an article on 'A New Standard Price for Gold' in so conservative a periodical as 'The Nineteenth Century and After'. In this eminently respectable British review Mr. Lancelot Ussher suggests that "the new standard be raised to 50% above the old, that is, somewhere in the neighborhood of the actual present market-price." He is so pleased with the idea that he speaks of it as "my scheme," and he concludes that the success of it "is tantamount to a gift by all the Allies (though it cost them nothing) of hundreds of millions to the United States, since she holds the greater part of the world's gold stock. But judging by her past record of unexampled generosity and open-handedness she will at once throw in the whole of this new found surplus to further the united aims of the Allies." It may have looked like that before the German capitulation, but conditions have changed, and if the United States does anything of the kind now it will be for reasons somewhat different. Mr. Ussher estimates that the natives of India have put away $500,000,000 of gold; he expects that this and other hoards would be induced to emerge from concealment if the standard price were raised. Another interesting statement is that of the Committee on Currency and Foreign Exchange after the War appointed by the British Treasury. In its report this committee says: "It is no secret that the creation of an immense volume of money and the raising of big loans in the foreign countries brought about the suspension of the gold standard." That can be said likewise of conditions in the United States. The committee is of the opinion that "gold is not expected to circulate as currency at any rate for a considerable number of years after the War," but we find no reference to any suggested change in the standard. Reports from similar committees appointed at Washington are due at an early date, and we look forward to giving them to our readers. Meanwhile we take pleasure in publishing further letters on the subject in our Discussion department.

A League of Nations

It is a parochial mind that is not keenly alive to the vital interest of the great subject that is uppermost at this time. We talk and dream of ending war. Our Allies in Europe approach the subject physically tired but morally exalted by the tragic experience of the four long years through which they have fought to the crowning triumph of November 11. The United States does not know the feeling of physical weariness but is likewise exalted morally by her participation in the struggle and by the honorable part played by her armies in the concluding battles of the Great War. The thinking part of the American people therefore is alert to the significance of this crisis in world politics. We face the most tremendous problem that has ever confronted civilized mankind. Unless the nations agree to ensure peace, they perish. The underlying idea is that the further development of scientific warfare, as shown by the testimony of recent events, will be such as to render another Armageddon a suicide of the human race. The elaboration of poisonous gassing, the extension of long-range artillery fire, the multiplication of submarine assassination are among the obvious contingencies, but worst of all is the development of aerial bombing, such that whole cities may be destroyed before a declaration of war. Mr. Mark Sullivan, in 'Collier's', has written well on the subject, but he makes the mistake of assuming that America is not menaced; that, although Paris or London may be blown to smithereens overnight, New York or Washington will be immune, because 3000 miles of sea intervenes. Such optimism is illogical. The first aeroplane crossed the 20 miles of the English Channel so lately as July 25, 1909; who shall say what the corsairs of the air may not be able to do in 1929? The Atlantic is a moat to military aggression, it may not suffice to protect us from aerial attack ten years

hence. Moreover, as Mr. Sullivan admits, in any future war, as in the one now happily ended, the contestants will appeal to the moral judgment of the United States and this country will be impelled, as in the present case, to support the side that is right, or lose its self-respect. American isolation is a thing of the past, our position today is one of splendid power, moral and material, but with that power goes an equal responsibility. Mr. Samuel Gompers has said truly: "America is more than a country. America is more than a continent. America is more than a name. America is an ideal." The spirit of her participation in the great conflict in Europe has been in accord with that ideal, and no aggressive war meant to subjugate a free people will ever leave her cold to an appeal for succor. We judge the future by the past. Therefore, we insist, the notion that the United States has no immediate interest in the proposed league of nations is a mistake. Next comes the question how to bring about the consummation of the idea for which President Wilson is given the credit of chief sponsor; he has gone to Europe as the leading exponent of the idea and he is believed to be in a position best able to bring it to fulfilment. If his noble purpose should fail, it will be, we believe, owing to the attempt to achieve two discordant aims concurrently. The intention of the Allies, when their representatives meet in conference at Versailles, is to see that Germany and her vassals are punished justly for their colossal crime in starting the War and in waging it with unexampled brutishness. That is one object of the conference; the other is to create a league of nations for preventing the outbreak of another such assault upon civilization. The two aims are incompatible. If Germany—for, in this discussion, we can omit consideration of her dupes—is to be punished for her crime today, can we ask her tomorrow to join in a friendly league to maintain peace? Would you condemn a man one day for behaving like a cad and ask him the next day to join your club? If Germany is treated with a severity such as is advocated, for instance, by Mr. Lloyd George, who wants to make her pay England's cost in the War, how can it be expected that Germany will be in a temper fit for association with the Allies within the time of this generation? Of course, Germany must be punished so condignly as not only to deter her from repeating her crime but also to warn any other power that may be tempted to imitate her monstrous performance; holding firmly to this idea, we deem it a manifest insincerity to expect her to become a loyal colleague with the Allies and the United States in a league to preserve peace. The basis of such a league must be international trust; there can be no confidence in Germany's promises to keep faith, her cynical disregard of solemn covenants is too recent and too damnable. The Germans have been beaten, but they have not changed in character, neither their government nor their people; until Germany has brought forth fruits meet for repentence there can be no reasonable expectation of converting her into a guarantor of international amity. Nor is she needed in that capacity. A league of 23 nations headed by the three great Allies and their great Associate exists already; this league was organized for war against Prussian aggression; it is well able to maintain peace, among other ways, by punishing the outlaw, who has now been defeated and captured. In days to come this defensive partnership may become a peaceful league and eventually it may include among its members a sadder, wiser, and repentant Germany. Until then the hope of civilization rests chiefly on the friendly co-operation of the three leading democracies, England, France, and the United States. They will suffice to keep order. The one unspeakable misfortune that could now ensue would be to create an atmosphere of misunderstanding between the United States and either England or France. A deliberate effort is being made, by German propaganda, to this end; and the difficulties inherent in the settlement of the political legacies of the War afford opportunities for differences of opinion. They can be avoided by separating the two purposes in hand, first, to bring Germany to account, and secondly, to create a league of nations for the preservation of peace.

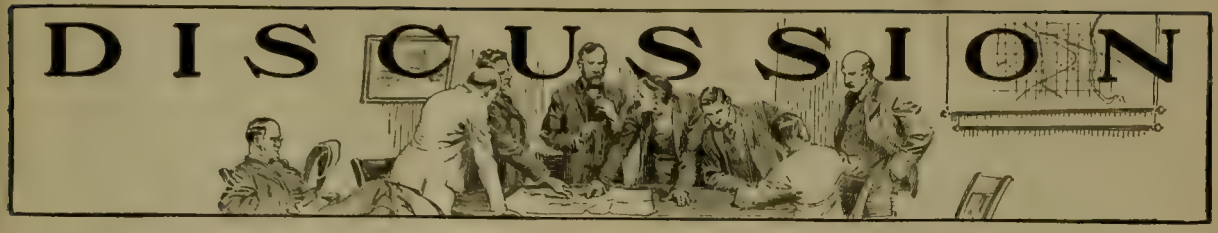
The Outlook

The phrase 'after the war' is not yet applicable to current conditions, we are in the midst of the interval between war and peace called an armistice; whereas actual fighting has ceased, except in odd corners of the map, the preparedness for resumption of war prevents an immediate return to the normal. A legal state of war persists and the special powers given to the Government have not been repealed. It is well that no sudden change in administrative functions is possible, for a complete relaxation of control would involve woeful confusion. Meanwhile the demobilization not only of the armies but of the industries created for purposes of war is proceeding in an orderly way. Much will depend upon the manner in which it is done. Our stock of patience will be subject to large drafts, for most of us are in a hurry to return to the pleasant ways that we connote with the phrase 'before the war', and we shall have to submit to a good deal of official regulation before the spectre of war is finally laid in the sunlight of peace. Those that are engaged in mining will have to suffer from many annoyances and uncertainties before things become as they were, if they are ever quite the same, which is unlikely. They have comported themselves patriotically during the great unpleasantness and they will be reasonable during the process of reconstruction, while on guard against the impositions placed upon them by sundry profiteers whose machinations have been hidden under the dollar halo. The War has shown the difficulty of regulating industry without enlisting the services of those directly interested in the commercial phase of the industry, thereby giving monopolistic groups the opportunity to gather information and to use tactics calculated to strengthen their grip on the small producers of metals. If a state of war had persisted for many years it is possible that the work of

Federal control might have passed by a process of elimination into the hands of men both competent and wholly detached from market influences, but in the rush to secure the supplies of metals needed for munitions it was impossible apparently to prevent such abuses of official power as we have seen in the fixing of prices for chromite and manganese, or the scarcely veiled dictation of the metal agencies in the adjustment of the markets for copper and lead. The only cure for these aberrancies is publicity such as it is difficult to obtain on account of the interplay of politics, finance, and bureaucracy. In the end the inexorable law of supply and demand spoils most of the schemes of the manipulators of markets, except during war-time, of course, when economics are held in abeyance by executive order. The rank and file of the mining community is not at all content with its subjection to the halo-hatted gentlemen at Washington and will be glad when their innings are terminated automatically by the signing of peace. Meanwhile it is to be hoped that some of the blunders made will be rectified during the interval and that pains will be taken not to wreck the various special branches of mineral development that have been created in response to the national need. During the War an intensive effort was made to render the United States independent of foreign supplies of sundry minerals, particularly those required in the making of special kinds of steel, such independence of foreign importation being necessary on account of the use of all our available shipping for expediting the transport of men, munitions, and food to Europe. The miners rose to the occasion and proved that they could find and produce the minerals heretofore obtained in other countries; would it not be a blunder to ignore this demonstration of our resourcefulness and become dependent again upon the foreign sources of supply? This is one of the questions made prominent by the experience of the last twelve or eighteen months, and we hope that it will be considered seriously by our representatives in Congress.

A Merger

The committee appointed to consider the question of uniting or affiliating the Mining and Metallurgical Society of America with the American Institute of Mining Engineers has reported in the affirmative. This committee consists of Messrs. Charles F. Rand, Joseph W. Richards, Robert M. Raymond, and Bradley Stoughton; it has reported that the constitution and by-laws of the two societies indicate that their aims and activities are practically identical, and that almost all the members of the junior society are members of the Institute. Whereas the requirements for membership in the Society used to be more rigid than those of the Institute, the recent changes made by the latter have made the requirements of both equally strict. Another difference, namely, the constitutional provision prohibiting the Institute from taking part in the discussion of public affairs, was removed five years ago. It will be seen, therefore, that the similarity of aims, activities, and membership points at the desirability of a consolidation. That is the opinion of the committee, which recommends that the Society be invited to consolidate with the Institute, with the understanding that any of its members, not now also members of the Institute, be invited to join the older organization; that the local sections of the two organizations be merged; that a bronze tablet be placed in the Members' Room of the Institute to commemorate the Mining and Metallurgical Society; that the directors of the Institute establish an additional committee on Ethics, Welfare, and Public Relations, the membership of such committee to be chosen from those now members of the moribund society. We have every reason to believe that this proposal to merge the two organizations will be put into effect. The bronze tablet is a lovely idea. The Mining and Metallurgical Society during its life failed to render itself worthy of the concluding, and most important, part of its name—"of America". It was born with the idea of being select and it will be buried under the epitaph of being exclusive. No technical society representing the mining and metallurgical profession "of America" could be deemed representative so long as its membership included about 250 men; to suppose even for a minute that only 250 mining engineers, geologists, chemists, and metallurgists in America were worthy of being included within such an organization is to ignore facts and to insult the profession. We estimate that a society so designated should have a membership of 2500, at least, including American mining engineers and metallurgists abroad. The fact is, the Institute has been nondescript and the Society exclusive, one had a tenth of those it might have enrolled, whereas the other had about twice as many as it should have included on the basis of any sort of reasonable selectiveness. Such being their relative positions, it is not surprising that the Society served as a nucleus of criticism and disaffection when the affairs of the Institute went wrong; indeed, the group of members identified with the New York section of the Society constituted the committee of reform that did yeoman service in re-organizing the affairs of the Institute a few years ago. They realized that the Institute was not living up to its full opportunities and that their own organization was growing too slowly to perform the representative functions necessary for the profession and the industry, so they spurred the Institute to a new and successful departure. They were reformers then, but they might have become 'revoltosos' at some future time. The idea of such a small number of men, all members of the Institute, maintaining a separate Society, based on the supposition that they were superior to the rest of a profession numbering thousands, was absurd. It is fitting that the failure of the scheme should be recognized at a time when other reactionary ideas are undergoing burial in the trenches of the battlefield. So we shall be pleased to be present, in spirit, at the obsequies of the 'M. & M.' and hope that the merger with the Institute means that the profession of mining engineering is now prepared to pull together for effective service in the peaceful days in store.



The Gold Problem

The Editor:

Sir—Upon reading the letters by Major Karri-Davies and Mr. F. W. Bradley in your issue of November 9 (for I assume B. W. F. to be a pseudonym for Bradley) I thought I would send you another communication in reply thereto, because you invited "useful discussion" regarding the subject.

The Major says, "it will be observed:

1. That the Government could and did alter the value of coin and that the people accepted the value placed on it by the Government.

2. That the gold standard was fixed (decided upon) on account of its convenience.

3. It was possible to alter the value of gold from time to time arbitrarily to meet conditions then existing. Why not do the same thing now for the same reason?"

He does not seem to understand that all the British government did, in altering the value, was to *change the weight of the metal in the coins* from time to time, which it did "arbitrarily" in its efforts to meet the changing ratio between silver and gold, so that both could serve as money at the same time. He seems to overlook the fact that he had previously quoted from the Act of Parliament, "that the gold coin shall be considered and is hereby declared to be the only legal tender for payment, and no tender of payment of money made in silver coin of any sum exceeding fifty shillings at any one time shall be reputed a tender in law."

Now, if it were possible for the British government to fix or determine arbitrarily the value (I understand that by "value" he means exchange-value or purchasing power) of gold, it could, also, just as readily arbitrarily fix the value of silver; why not? But, as a matter of fact, absolute and incontrovertible, no Government can legislate value, for the simple reason that all exchange-values are relative and they are determined solely by the exigencies of trade and commerce.

Again, the Major, in his brief statement of the history of gold money in England, noted that "each time a change (of weight) was made in the gold coin a new name was given to it," but he seems not to have understood that the reason for changing the name of a coin was that different weights and fineness of metal must, necessarily, receive different names to enable people to understand what was meant when any particular name was used. 'Pound sterling' and 'sovereign', *now*, are used interchangeably because they both mean precisely the same weight of gold; but if they each meant a different weight of gold, or if they meant the same weight of gold but of a different fineness, or if they meant the same weight of different metals, manifestly they could not be used interchangeably. Similarly the words 'price' and 'value' must not be used interchangeably unless they are so qualified or explained that their meaning is unmistakable.

In the ordinary sense, all values are relative, that is, comparative. 'Price' is the value of anything expressed in terms of a certain weight of the standard of value, which is called the unit of exchange-value. Gold is the *standard of exchange-value* in most civilized countries today, but in nearly all of them the unit of exchange-value is a different weight of the standard. That is to say, in England the unit of exchange-value is 113+ grains of fine gold which has been named a 'sovereign'. In the U. S. A. the unit of exchange-value is 23.22 gr. of fine gold, which has been named a 'dollar', and so on for other nations.

A government may and does select its standard of exchange-value and may and does decide upon what weight and fineness of such standard shall constitute its unit of exchange-value; all of which it does "arbitrarily"; but when it comes to determining the worth, exchange-value, or purchasing power of such a weight of such standard of exchange-value, a government has no more power to say what it is worth than you and I and the rest of us, who constitute the nation, have. As before stated, the worth, exchange-value, or purchasing power of such unit of value depends solely upon the exigencies of trade and commerce, within nations and between nations. Furthermore, these units of value and multiples and divisions thereof in the form of coins are the only *real* money of any nation that has adopted metal money. They are its medium of exchange. There is now no real money in circulation in the United States of America because there is no such thing as *paper* money.

If anyone will take the trouble to read the various inscriptions on paper-notes, bank-bills, etc., it will be observed that they are *promises to pay money* and, as long as the people have confidence in the Government, Federal Reserve Banks, National Banks, etc., such paper promises to pay money will pass current as money, at their face-value, but no longer. They are not money *in fact* though they may be included under the general term curren(t)cy', which means both money and paper promises to pay money.

Neither Major Karri-Davies nor Mr. Bradley appear to realize that governments *do not* fix the exchange-value

or purchasing power of gold coins. All that governments do is to fix the weights of gold in the coins and give them names by which they may be identified. "A rose by any other name would smell as sweet"; so also an ounce of gold by any other name, than "85 shillings", or "20.67 dollars", will buy as much. Mr. Bradley, particularly, ought to realize that the gold he gets from his mines now does not buy nearly as much labor and supplies as the same amount of gold would have bought before this war. But this condition of affairs is not due to any legislation, by the Government, which has changed the weight of gold in the coins. In this connection the Major proposes:

"The new standard-value of gold would be fixed by the financial conference of the nations. It might be $40 per ounce or any other figure that the Conference in its wisdom decided; provided it was accepted by the world, the figure would not matter."

There is no such thing as a "standard value of gold", if by "standard value" 'fixed' value is meant. "$40 per ounce" is not a 'fixed' value; it is what is termed a 'mint price' for gold, the word 'price' meaning the exchange-value of anything expressed in terms of a unit of exchange-value. As explained before, all exchange-values are relative or comparative, and, therefore, in expressing the exchange-value of anything it must be expressed in terms of something else. Hence, it is impossible to express the exchange-value of gold in terms of itself.

"$40 per ounce" means, literally, that a 'dollar' is one-fortieth of an ounce and, if a Troy ounce is meant, a 'dollar' will be 12 grains, whether gold or silver or copper or tin or any other metal is selected as the monetary standard. And the exchange-value or monetary value of that particular 'dollar', whether it be gold or silver or copper or tin, will be precisely what 12 grains of gold or silver or copper or tin may be swapped or exchanged for at any particular time and place; for time and place are elements that have bearing upon the determination of the relative exchange-values of gold and silver and copper and tin.

To recapitulate: Webster's dictionary defines money thus: "A piece of metal, as gold, silver, copper, etc., coined or stamped and issued by the sovereign authority as a medium of exchange in financial transactions between citizens and with the Government." Also, in a comprehensive sense, "Any currency usually and lawfully employed in buying and selling". The late Horace White, in 'Money and Banking', defines it as "A commodity which mankind voluntarily accepts in exchange for all other commodities and services."

The 'mint price' of 85 'shillings' or 20.67 'dollars' per ounce for gold means, simply, that a Troy ounce of gold when minted, or coined, will produce the equivalent, in sovereigns, of 85 'shillings' or 20.67 'dollars'. Otherwise the word 'price' as applied to gold is a misnomer, and causes endless confusion and misunderstanding when so employed.

So-called 'paper money' is not money. It consists simply of promises to pay money (that is, gold coin) and as long as such so-called money is 'convertible' it must be redeemed, eventually, in gold coin, or its equivalent. Therefore, if gold in the form of bars, nuggets, or 'dust' is paid for in Federal Reserve notes, or Federal Reserve bank-notes (for both kinds are issued), National bank-notes, greenbacks (United States notes), or any other form of 'convertible' *paper promises to pay gold*, the transactions mean that the sellers of the bars, nuggets, or 'dust' have accepted the promise of the Government or the banks to pay them an equal amount (weight) in gold coin. And as security for such promises the Government and banks together have, approximately, 55% of the necessary gold on hand. This brings up the element 'credit', which opens up such a vast field for argument it seems best to stop short; adding, only, that it might interest some of your subscribers to read the inscriptions on the different kinds of paper-promises-to-pay money. The transmutation of paper into gold is successfully accomplished with the aid of credit, for all practical purposes, sometimes. But when confidence disappears 'paper-gold' goes with it.

W. DEL. BENEDICT.

New York, November 21.

The Editor:

Sir—The letters by W. Karri-Davies and B. W. F., appearing in your issue of November 9, on the subject of 'The Gold Standard', are certainly of interest. It seems to me that the basic idea should appeal strongly to all mining engineers.

The calling in of "all the present existing gold (bar, coin, jewelry, or any other form) . . . and all enemy gold of every kind" by each nation of the future league of civilized nations (with the subsequent re-valuation of pure gold as 40 dollars, 8 pounds sterling, or 200 francs per ounce) would undoubtedly cause wild wails of protest to issue from some quarters.

Viewing the idea calmly and deliberately, it appears that the present civilized possessors of gold in whatsoever form have no just cause for worry. A hasty conclusion might be that Mary and Jane and Eloise will have to part with their treasured trinkets, even to grandma's wedding-ring. But it need not reach that stage. Should the various governments in question agree on a plan based upon the suggestions of Messrs. Karri-Davies and B. W. F., a simple modification suggests itself.

The possessors of gold in a form such that it has, for them, a value not measurable by mere money should be permitted to submit the article in question to a duly authorized representative of their government for appraisal. After such appraisal and upon payment to their government the difference represented by the enhanced value of the contained gold, the articles should be returned with a certificate bearing a description of the articles and a receipt for the payment made. A similar ruling should be made for manufacturing, wholesale and retail jewelers; as well as for temporary custodians of jewelry belonging to persons in temporary distress. The certificates should be transferable a stated number

of times, to facilitate the ordinary phases of commerce in such articles. In such rare cases where the possessor (or ci-devant possessor, temporarily alienated and presumably less rare than the foregoing) failed to possess, at the moment, the money necessary for the payment to his government, a lenient government such as ours might act the part of a benevolent 'uncle' for a stated time without charging the high rates per month so common to commercial 'uncles.'

A carefully-planned re-valuation of existing gold would cause no hardship whatever to the people. The civilized peoples of the earth would not lose one cent, penny, centime, or centavo. "How is that?" says the casual reader; "nobody gains; then what's the use"? Yes, somebody gains. The people, as individuals, lose nothing. The peoples, as bodies politic, gain the seigniorage. In the case of the people of the United States of America this represents, approximately:

Total ounces $\times$ ($40 – $20.67) – net mint expense.

The ratio for Great Britain and France, as outlined above, will no doubt allow those peoples a slightly larger margin of profit; but do they not deserve some consideration for bearing the brunt of the conflict about to end?

The item of Major Karri-Davies' letter that gives me great joy (almost as much as that which I derive from the contemplation of what a boost the mining and allied industries will get) is that where he says "of the world . . . the annual production about $450,000,000 of which the Allies produce 91.3%, the Neutrals 8.1%, and the Central Powers 0.6%." There is no room for argument. All we need is discussion in the right place.

W. B. McKinlay.

Santiago, Cuba, November 18.

Process for Recovering Platinum

The Editor:

Sir—In your issue of October 12 you print an article by V. J. Zachert in which he claims to have discovered a method for amalgamating platinum, and describes the method.

Mr. Zachert does not state how long he has been using this method, so it may be difficult to say whether or not his was the first 'discovery'. While carrying on an investigation of California's platinum resources in 1917 under the direction of the State Mineralogist and in cooperation with the U. S. Geological Survey, I met in Oroville an old gentleman named A. H. Sherwood, who has been successfully amalgamating platinum metals in dredge-concentrate for several years past, on a small working-scale. Sherwood makes use of an acidulated solution of copper sulphate to obtain a coating of metallic copper on the platinum particles, but his method and apparatus are much simpler than those described by Mr. Zachert. Mr. Sherwood's process is rapid, the recovery appears to be all that is desired, and the chemical reactions are positive under proper conditions. He demonstrated his process to me, and offered the use of it to the Government for war purposes without cost. I was so impressed with the possibilities of the method that I arranged for a second demonstration by Mr. Sherwood before a representative of the U. S. Geological Survey to whom Mr. Sherwood repeated his offer to permit Government use of his process. It will thus be seen that the Government, through its representative, has had full information on the subject for 13 months, and was in a position to use the process if it so desired.

A few months later, in conversation, I confidentially mentioned the Sherwood process to Prof. W. C. Blasdale of the Department of Chemistry, University of California. Professor Blasdale will corroborate me when I say that he was somewhat skeptical when I described the agencies used and the results obtained. Because of the comparative insolubility of the platinum group of metals it did not seem possible to create the electric cell required, with the means used. I thereupon demonstrated the process to Prof. Blasdale in his own laboratory. It took only a few minutes to show that, under special conditions, the copper plating of platinum particles and their immediate amalgamation with plain quicksilver was possible. Zinc amalgam is not required. The process works equally well on pure platinum, on osmiridium, or on any of the intermediate alloys.

Mr. Sherwood's application for patent had been before the Patent Office for some time before I met him. He has obtained patent for one stage of his process. When he first applied for patent, the Patent Office said that two processes instead of one, were involved. They gave him a patent for the final step, which consists of "separating amalgamated gold and platinum metals," but refused patent on the process of amalgamation because, as Mr. Sherwood said, they held his formula to be "untenable." At the time he applied for patent, he did not understand the chemical phenomena involved well enough to state correctly just what occurred, and said that I was the first one who had clearly explained it to him. I was never able to learn just how he came to evolve his process. Early in 1918 he planned to amend his application, but I am not advised whether he has yet obtained his patent. If a remember rightly, however, he stated that a patent was granted in Washington for amalgamating platinum by the help of copper sulphate about 80 years ago. Mr. Sherwood hoped to circumvent this fact by making his application cover "a process for amalgamating gold, platinum group metals, and other metals."

There are other factors, such as temperature, condition of the mercury, and classification of the sand treated, which seem to have an important bearing on the success of the method, and which have not been mentioned by Zachert. Mr. Sherwood believes that a solution of certain temperature gives best results. He also believes that classification should be used, and separate treatment resorted to for saving the finest gold and platinum, which are in the slimes.

James W. Neill points out in your issue of November 23 some of the obstacles in the way of using the process on a large working-scale. He has also mentioned a point

regarding which I take issue with Mr. Zachert. I have been advised by employees of the Natomas Consolidated of California that the Neill jig is very successful in saving 'black' or 'rusty' gold, but that most of the platinum recovered comes from re-concentrating the black sand from the dredge-tables on a Senn panning-motion batea.

C. A. Logan.

San Francisco, December 3.

Copper Production of Mexico

The Editor:

Sir—In your issue of the 16th inst., under the caption, 'Copper Production of Mexico', quoting from the 'Boletin de Minero' for the period of May and June 1918, you give as the total production of copper from Mexico for 1917, 211,252,126 pounds; and of this amount the State of Nuevo Leon is credited with 183,365,000 lb., while the State of Sonora is down for only 68,396,865 lb. I have not had an opportunity to see the original figures in the 'Boletin de Minero', but I feel sure there must be some mistake in these figures, especially since your total does not check with the amount credited to the various States. I shall be interested to know what the correct figures for the copper production for the period was.

Royal P. Jarvis.

Cananea, Mexico, November 25.

[In our issue of June 22, 1918, page 848, we published a table giving the metal production of Mexico for 1917. This was also from the 'Boletin de Minero'. The total copper output was 141,528,966 kg., of which 31,089,484 kg. was credited to Nuevo Leon and 83,348,000 kg. to Sonora. In the original these totals were reversed, and thinking as our correspondent does, that there must be a mistake, we gave Sonora the larger output. In our issue of November 16 we failed to do this again, hence Nuevo Leon showing the larger yield.—Editor.]

The Utah Copper Enterprise

The Editor:

Sir—In reading your article on the history of the 'Utah Copper Enterprise', I do not see reference to an option on the property held at one time by L. C. Trent. Perhaps the following may be of interest:

In either the latter part of 1902 or the fore part of 1903, I met L. C. Trent in New York. He said: "Wiseman, you are just the man I wish to see. Tell me something about the concentration of low-grade ores at Clifton, Arizona." I spoke to him at considerable length concerning the character of the ore and the method of treatment. He then remarked: "Wiseman, I think I have the biggest copper mine in the world." "Where is it?" "It is in Utah. There are two railroads crossing the property, there are mountains of ore, and while the crude ore only averages about 2% copper, I can make concentrates from it that will go 30% and over in copper." I asked him what he was going to do with it, and he answered: "I am back here for the purpose of getting some parties interested in it."

One year later, I met him in San Francisco and I remarked: "What about that whale of a copper mine that you were telling me about?" He replied: "Wiseman, you know that I know all the big mining interests in this country. I went to them all and explained the proposition and they simply laughed at me. They said it was ridiculous for me to come back there and try to make them believe that I could get 30% concentrate out of a 2% ore and that a 2% ore under the conditions I named would not make a commercial proposition. I offered to a Boston crowd to pay all the expenses of their engineer if they would have him make examination and he reported that the property was not in every respect as I represented it. And they even turned that proposition down." I then asked him what the property was and he said that it had been taken hold of by others and was now known as the Utah Copper Company.

At the time I met Mr. Trent in New York, I had recently resigned as the general manager of the Shannon Copper Co. after I had spent about two years at Clifton, of which fact he had knowledge.

I note also that you refer to the underwriting of $3,000,000 worth of bonds for the Utah Copper Co. by the Guggenheims. My understanding of the way in which the Guggenheims became interested is as follows: Seeley W. Mudd, now Colonel, was acting at about that time as south-western representative of the Guggenheim Exploration Co. He was called upon to make an examination of the Ohio Copper Co. and he asked me to assist him in that examination on account of the knowledge I had gained of that type of ore while at Clifton. The sampling of the Ohio Copper gave an average so greatly below the average of the Utah Copper that the option on the property was not exercised. While making the examination of the Ohio Copper, Mr. Jackling gave Mr. Mudd the privilege of going through the Utah Copper and I accompanied him on the trip. At that time, or very shortly afterward, Mr. Mudd learned of the additional financing contemplated by the Utah Copper Co. and he took the matter up with the Guggenheims and this led to the examination of the Utah Copper at a somewhat later date by Mr. Mudd and the eventful underwriting of the bond-issue.

Philip Wiseman.

Los Angeles, December 4.

Molybdenum-Steel

The Editor:

Sir—In looking over your issue of October 19, I note an article by L. F. S. Holland. In the last paragraph of this article, Mr. Holland states that the Metals Reduction Co. is making ferro-molybdenum at Washington, Pennsylvania.

Mr. Holland, by some means or other, has got hold of the wrong name. Our company, the Electric Reduction Co., numbers among its officials such men as have been intimately associated with the high-grade steel

business for a dozen years or more and these men have been interested for some years in the possibilities of molybdenum, as an alloy with steel. Early last winter we began to pioneer among the steel-men with an idea of introducing various molybdenum-steels which we now offer. Soon after that time the Government became interested in our steels and largely through these two separate lines of endeavor, we became engaged in the manufacture of molybdenum.

We are at present producing approximately 60% of the molybdenum produced in the country and as soon as the War is over, we will resume our efforts to introduce molybdenum-steels for many uses which are, of course, of little interest in this crisis. We feel that you would like to have this information and that perhaps you would be kind enough to publish in your issue a correction, which would set this matter straight.

CLIFTON TAYLOR.

Washington, Pennsylvania, October 28.

Water Laws of Nevada

The Editor:

Sir—The periodical entrance of new legislators, presumably for the adjustment of the State laws under which we work and by which we are worked, while so frequently giving a presentation of that nature which suggests the applicability of Hamlet's remark to the effect that "'Twer a custom more honored in the breach than the observance", still, with each succeeding exhibition lends reason to the hope that legal defects may be corrected, and obscure law passages made clear.

It is rumored that the water laws of Nevada are to be readjusted during the coming legislative session, and every man who is operating a mine or mill upon a water-supply obtained from his vein or dike, or from any subterranean channel or watercourse should interest himself in the proposed legislation. It is probable that the larger consideration will be given to waters available for irrigation, but as Nevada is first a mining State and possessed of but little water, the safeguarding of the water-rights of those who invest their money and years in mines and mills should be of grave import to our legislature. The danger to the class of operators mentioned can be best illustrated by references to a case in point.

Eldorado canyon, in the south-east corner of Nevada, is the result of erosion along the lines of weakness that accompany a strong porphyry dike that was thrust up through an older andesite intrusion in a monzonite country-rock. The cooling and shrinkage movements were chiefly along the foot-wall of the more recent porphyry dike, causing, along that contact, a brecciated and open condition that became a subterranean watercourse, which yields water in an otherwise arid region, wherever it is opened throughout its length of ten miles from the summit of the range, easterly along Eldorado canyon to the Colorado river. This dike now carries the only water of consequence in that region, and, in former ages, it was the channel along which passed mineralized solutions, as evidenced by the deposition therein of gold, silver, copper, lead, and zinc.

In this dike a shaft was sunk, cross-cuts were made, and considerable driving was done along the foot-wall. The shaft drew water from the foot-wall of the dike. The cross-cuts into both walls have always been perfectly dry. The dike foot-wall exposed by the drifts on three levels is always wet with incoming water having a course eastward, down the canyon toward the Colorado river. A strong cross-dike, readily traced for two miles, cuts and faults the dike in question near the shaft mentioned, but the crossing dike is perfectly dry, showing the absence of any general water distribution in the region.

This mine development was the first exploitation of any extent in the dike, and it resulted in the opening of a most promising mine. As several years baling from the mine-shaft had proved a daily yield of from 9000 to 20,000 gallons of water, varying with the season, and as no other parties were using either the surface or subterranean waters of Eldorado canyon, or had made any water-filings in the entire district, the company that had opened up this ore and water filed upon the water flowing along that subterranean channel and also upon a certain portion of the surface water that flowed upon the canyon-floor for a time after the rainy season. These filings were approved and granted under the Nevada laws, a 75-ton cyanide-mill was built upon the property, and mining and milling operations were commenced.

At about this time lessees had erected a mill upon a mine in a gulch parallel to Eldorado canyon, found their mine and gulch carried no water, bought some non-mineral claims a mile up the canyon from the first mentioned developments and covering the water-carrying dike, sank therein for water, with success, and pumped the dike-water over the mountain to their mill, thereby diverting the water of Eldorado canyon from its natural channel, with the result that the dike ceased to supply water to the mine-workings of the parties who had developed the water and to whom it had been granted by the State, and consequently their mining and milling operations had to be stopped, and so now remain. The cause was tried in the Tenth Judicial District and the interpretation of the Nevada laws permitted the continued diversion of the water of Eldorado canyon from its natural channel and from the service of those who developed it and had held it in undisputed possession and beneficial use for several years.

The trial of this case developed obscurities in the Nevada water-laws resulting in conflicting opinions among the attorneys touching various points. For instance, while the laws of Nevada proclaim that waters flowing in channels whose boundaries and direction of flow are possible of determination belong to the State, and are therefore subject to appropriation under the State laws; and that percolating waters are not subject to such appropriation; there is a wide difference of opinion among the lawyers and judges as to the classification of percolating waters. The definitions of per-

colating water in the books of authority on both California and Nevada water-law are inexact and insufficient; probably because it has not seemed necessary to place upon record a close definition.

As courts and judges can, by visitation, and tests, satisfy themselves as to the physical nature of any ground formation in question, it seems to me that an exact and complete definition of percolating water should be established and made of authority, and as a starter, the following is suggested:

Percolating water is ground-water existing in that porous character of earth or rock that permits the water to yield to the influence of capillarity and gravity, which influences cause a general diffusion of the water through its containing medium, thus creating in the containing earth or rock a semi-saturated or saturated condition of indeterminable boundaries and direction of movement.

This definition might be accompanied by a note to the effect that, in such an area the contained water adjusts itself closely to a general level known as the water-table, and shafts sunk anywhere in such an area to a depth below the water-table must, because of gravity and capillarity, accumulate water, which will rise to the level of the water-table of the region. Such shafts may become accepted demonstrations of the nature of the ground-water of any region, and a box of sand partly filled with water, or a partly submerged block of sandstone may be conveniently used for illustration.

The hard crystalline rocks of the Eldorado mining district are impervious to water, as evidenced by the dry shafts, drifts, and tunnels along the Eldorado dike-course, unless they cut the water-channel described above, and as further proved by the necessity of the coming of the successful party to this suit to the Eldorado canyon vein for water, while his own vein is parallel thereto, his shaft the deepest in the district and but 200 ft. north of the mine development described in Eldorado canyon, a low mountain intervening.

Notwithstanding the clear and abundant evidence as to these ground conditions, some of the attorneys in the case were of the opinion that the waters in question should, under the Nevada law and practice, be designated as percolating waters. The Court, while uncertain upon the point, did not decide the case upon that assumption. In this case Nevada legal practice and decision have established the following condition in Eldorado canyon:

The shaft of the suffering parties is six miles up the canyon from the Colorado river. The well of those who are diverting the water is one mile farther up the canyon; leaving the upper three miles of Eldorado canyon and its water-conducting dike open, under the Court decision, for repeated exploitation for water, each successive well shutting off the water from its neighboring well below it in the canyon.

The absurdity, inequity, and danger to mining investments in this condition should not be permitted to obtain and extend in Nevada. May not the mine-owners of Nevada lend aid to the legislators in the coming adjustment of the water laws of the State; and have any of the brethren suggestions as to the clarifying of legal dicta applicable to the case quoted?

G. A. Duncan.

Nelson, Nevada, December 5.

Spitzbergen

The Editor:

Sir—Your issue of November 2 contains an article respecting Spitzbergen and its coalfields. 'The Economist' of October 5 contains an article which differs somewhat from yours. It states that the international conference at Christiania in 1914 "was broken off by the War. No report of its proceedings seems to have been published, but the treaty of Brest-Litovsk pledged the German and Bolshevik governments to ask the Norwegian government to resume the conference, and endeavor to internationalize the islands on equal terms for Germany and Russia. The British government has hitherto declined to take action in regard to the islands during the War, but it was hinted by Lord Robert Cecil in Parliament in November 1916 that German claims pegged out during the War might not be recognized afterward."

You state that "W. S. Bruce, when reading a paper before the British Association for the Advancement of Science, in 1913, urged his Government to annex the island, but the suggestion was ignored, properly." The concluding words of the foregoing indicate that you are not aware that, early in the seventeenth century, Spitzbergen was a British possession, but was abandoned when the whales deserted its coasts. Whether Great Britain has, or has not, a reversionary right to Spitzbergen, it can at least be conceded that her claims are superior to those of any other power.

James White.

Ottawa, November 14.

The Alaska Treadwell, Alaska Mexican, and Alaska United companies, on Douglas island, own and operate three hydro-electric plants, one at Nugget creek, one at Sheep creek, and the '240' plant which utilizes the water-power from the Treadwell, Mexican, and United ditch-lines. These three power-plants have been all 'tied-in' with the Alaska Juneau steam-electric plant on the mainland across Gastineau channel for operating reliability, efficiency, and economy. This has enabled the Douglas island companies to sell and to offer for sale all their steam-electric generating machinery and boilers. The power output of the four tied-in plants is charged out according to the kilowatt-hours consumed (the Alaska Juneau being the largest consumer) on the basis of all operating costs plus a 10% interest and depreciation charge on the capital invested in the plants and equipment. The net earnings of the Douglas island companies under this arrangement have been $62,687 for 1917, and $15,494 for half of 1918. The decrease in 1918 is because of the dwindling power requirements of the Alaska Juneau due to the shortage of labor.

A Letter From the Front

THE BATTLE OF THE ST. MIHIEL OFFENSIVE

These past months seem like so many lifetimes, because they have been crowded with so many wonderful experiences, but the most wonderful of all is the one I am going to try and tell you about now.

Of course, you have read about our recent little show staged in what was the St. Mihiel salient. The papers, I am sure, have told that story and probably have given it many unnecessary high lights and used many lurid phrases of self-accredited glory when describing this little affair. So if you don't mind, I will confine myself to my personal experiences.

The official designation of that section of the General Staff known as 'operations', to which I am attached here at G. H. Q., naturally implies the planning of what commonly are referred to as 'battles'. But there is quite a distinction between a 'battle' and a military 'operation'; the latter is far more comprehensive in its scope.

Soon after undertaking my present job I, in the natural course of events, had to be informed of the proposed St. Mihiel operation, because I was required to work on the amazingly elaborate plans necessary to the success of such an undertaking. Little did I think, when I was struggling along with those damnable map-problems at the Staff College last winter, that I would so soon be called upon to apply the theory and practice to a situation in which I would be dealing with real men by the thousands, real conditions, and be assuming the responsibilities of sacrificing many human lives perhaps when making a miscalculation or a mistake in judgment. In the map-problems, when I balled things up, I only made a fool of myself and got a rotten mark on my work. But in this case, rotten marks would be symbolized by hundreds of graves filled with American soldiers. So perhaps you can appreciate to a degree what a terrible strain it is upon one's mentality and conscience to be placed in such a position.

Don't think for a moment that the part of the work entrusted to me was of great importance, yet in planning such a thing, every little detail has its direct bearing on the thing as a whole, no matter how insignificant that detail may be; and no matter how low in the scale of importance my particular job happened to be, it was sufficient to give me more than one brain-storm of the most acute worry I have ever known. Gosh! I lived and dreamed and talked the thing until my brain seemed to refuse to function on any other subject. I studied every conceivable type of map of the country so constantly that I felt I could recognize any square foot of it in the dark as an old and familiar friend.

Doubtless I am boring you with this long and involved effort to tell you about how we all worked so constantly on this thing and at the same time maintaining the greatest secrecy, yet it *was* a terrific strain, though wonderfully exciting and thrilling, for it was to be the maiden effort of the American Army, which was still so young and crude, and naturally the few of us who knew what was projected wanted it to be successful, if human effort could make it so. Well, it *was* a success of more than minor importance. Of course not to be compared with some of the really big things done by the British and French, yet considering its tactical advantages and its influence (both directly and indirectly) on the situation as a whole, it is nothing to be ashamed of, considering that the same thing had been tried twice before by others and had been a failure in each instance.

After this prelude maybe you can picture my state of mind when I left here two days before the show began to go up and watch the performance. Being unrestricted in my movements and for the time being vested with authority to issue orders in the name of the General, if I considered it necessary, I left here in my car one afternoon in a frame of mind that ranged between exultation and sickening dread. The red, white, and blue silk brassard with its 5-pointed star embroidered in gold, the insignia of a General Staff Officer from G. H. Q. that I was wearing, represented far greater authority than I ever expected my humble self to possess. I shall always treasure that bit of silk for its association with the most wonderful moments of my life.

Feeling that I knew where the most interesting things would happen, I went first to the headquarters of the Army Corps covering that part of the front. After getting the information I wanted there, I decided that a certain division would be the unit that would develop the situation in which I was most interested, so I went to the P. C. [Post Command] of that division. Subsequent events proved my guess to have been a good one.

The weather for a week before the show started had been unusually rotten. Torrents of rain had made all of the roads quagmires. This had its disadvantages, but really played into our hands, for it helped us to make our concentrations with most successful secrecy and made the surprise party almost complete to the Boche. After arriving at the Division P. C., I decided that to see the real thing, I would have to go up to the actual front and see the thing off. As you perhaps know, the attack was preceded by a four-hour bombardment, and when that began, I went up to one of the attacking battalions and attached myself to a company, for by this time I had decided that the only way to test the efficacy of the long worked-over plan and to form a basis of possible future plans, was to watch the thing function from the actual

front line and work from there back to the higher command, rather than reverse that order. Also, I had a pretty well defined idea that when that line once got started, it would be devilish hard to catch up with again.

It was raining with almost tropical violence, and though I had discarded everything but my map-case, prismatic compass, and gun, it was no easy matter to make my way up to the jumping-off line. Gee, it was spooky! Part of the time I was knee-deep in mud, while on the road, and then having to make straight across country following the compass-bearing. That little trip of about three kilometres taught me some valuable lessons.

I left the Division P. C. at 1 a.m. and knowing that zero hour was to be at five, of course four hours seemed absurdly ample to cover the distance of less than two miles. As a matter of fact, it took me nearly three hours, and you will laugh at my stupidity when I tell you why. In order to protect my compass, a delicate and expensive instrument, from the rain, I held it close to my face while reading it in the dark; but in addition to protecting it from the rain, my steel helmet also caused a deflection of about fifteen degrees, which was something that I did not reason out for about an hour, by which time I was a considerable distance from where I was headed. I am glad to say that I did have sense enough to comprehend the trouble at last, and from then on, when I made a reading, I removed the 'tin' hat and protected the compass with my hand. Is it any wonder that I am in a constant state of fear that some day they will discover what a bone-head I am?

Having left my rain-coat behind, of course I was drenched, yet I was not cold, because I had too many other things to think of.

At last I found the exact place for which I was looking by stepping on the legs of one of the men lying just outside the jumping-off trench. My arrival was duly heralded by a mild outburst of profanity from both the man on the ground and myself, actuated on his part doubtless because of the hob-nails in my shoes, which hurt like the devil when pressed into his legs, and on mine because I was startled almost into a spasm when I realized that I was standing on a human being.

Having about an hour to wait before zero, I found the platoon commander, who happened to be a boy from Virginia who couldn't get nearer than 'tar' to the accepted pronunciation of 'tire', as I learned in subsequent conversation, and laid down beside him. I have been a bit uncomfortable in my life, but those sixty minutes lying in the mud and drenching rain come pretty close to being the most damnably uncomfortable period of my 39 years existence. Yet I would not take a million dollars a minute for it now.

We were just over the crest of a small hill and had a perfect view of the country in front of us for quite a distance.

I am not going to be such an idiot as even to attempt to describe to you the effect of the perfect hell of shell-fire that our guns of all calibres were raining all over that trench system. It seemed as if the whole world as far as the eye could see, was a huge inverted collander with spurts of liquid flame shooting through each of the thousands of holes, the size of which being determined by the size of the bursting shell. It really was a mystifying illusion and it was practically impossible for me to realize that the whole world was not afire under its crust, and that the flames, being urged upward by some demon in hell, were frantic in their fear and haste to escape from their diabolical tormentor. It seemed impossible for me to comprehend the thing and believe in its reality.

During such moments of mental stress, one's mind plays many pranks. I would suddenly find myself oblivious of the marvelous spectacle out there in front and awaken to the realization that the youngster shavetail lying beside me was discoursing on the merits of the Stutz car we drove at home, which explains how I knew he couldn't say 'tire'. Well! we simply waited for zero, consulting our watches occasionally, so as to know when to prepare to start. I knew what was going to happen at zero hour and really would not have needed a watch to know when it arrived, but I actually counted the seconds of the last minute as a matter of curiosity, to see how near schedule our barrage would be put down. Just as I counted the 59th second the peculiar half-bark and half-crackle of the 75s, which you soon learn to distinguish, began with a ripple; then ran across the front and almost instantly merged into a continuous roar, and out in front about a hundred metres away, you could see a lurid line that paralleled the departure trenches almost as perfectly as if it had been laid out with a T-square. Everybody was glad to get up and stretch a moment and then start forward at a deliberate pace. It was known that the barrage would advance at the rate of 100 metres per four minutes, so the only thing you had to do was to keep your place in the line and keep on going. You instinctively feel when you are the proper distance from the barrage, and as you expect an occasional 'short' it does not seem to disconcert anyone when it arrives. If you are too close to it to avoid stopping a fragment, well, that is the rub of the green and you are just out of luck.

The Boche had spent four years of constant work in organizing their position and when a few hours later, under more placid conditions, I had a chance to examine the maze of wire and intricate trench system that looked like some huge and complicated *motif* of lace worked in the ground, I marvelled at the possibility of anybody getting across it, yet that bunch did cross it in perfect order and with a nonchalance such as you would have considered possible only when strolling along a perfectly graded cement sidewalk. Somehow you didn't know that any wire was there and of course it was comparatively easy to jump the trenches. Please believe me when I assure you that so far as I was concerned, I was hardly aware of the wire or other obstacles in my path at the time and not until I began to trip over what had been a pair of shoes and wrapped puttees, which upon

investigation I discovered were reduced to ribbons, did I have any real consciousness of having crossed that wire. If you had seen me when I returned to the P. C., you would have laughed, for nothing worth while was left below my knees, either of my breeches, puttees, or shoes, so I resorted to the brilliant idea of using some first-aid bandages in place of what *had* been a perfectly good pair of Fox Frayless.

Well! that is about all there was to it. They simply kept on going, and at no time did they vary more than 12 seconds in reaching any of their objectives. The Boche didn't have much fight left in him after that bombardment, and did surprisingly small execution with either his machine-guns or his artillery. Only two men were killed in the platoon I was with and not many others were wounded. I continued to advance with the line until about 7 a.m. and then decided to return to the Brigade P. C. to report the exact position and progress of the attacking line. All telephone wires had by that time been cut by shell-fire. Naturally I thought that progress to the rear would be easier than going in the other direction, but as a matter of fact, the real excitement of the morning was still due me.

A well organized mopping-up line was following the attack to clean up all out-of-the-way places that the front-line troops could not waste time to bother with. These moppers-up were doing their job quite thoroughly and were not as close up to the front line as I thought, as was made evident by the number of Boches still to be seen darting about in the rear of the front line; but still I thought nothing of that until I discovered that these stray Boches were not as friendly as they should be under the circumstances. Well, that is where my real fun began. In going through a small wood with rather thick underbrush, I kept my eye peeled for trouble and my automatic in my hand, though I really did not expect to use it, wherein I was mistaken. About fifty feet ahead of me I observed a Boche duck behind a tree in a rather threatening manner, so I approached cautiously, thinking he would surrender, but as I stepped into a small cleared space, the fool let go with a hand-grenade and ducked behind the tree again. Knowing that at least six seconds must elapse before the thing exploded I naturally ran away from it, but in the direction of the tree behind which he had ducked. I arrived at the tree just as the grenade exploded and as he put his head around to see what had happened, his nose almost touched the muzzle of my gun, and it makes me chuckle to think how surprised he must have been if he had time to think during the fraction of a second that elapsed before I pulled the trigger. I don't know what he looked like, because I couldn't get a good look at him during our little dodging match, and afterward—well, his face, or what was left of it, was not very pleasant to look at, so I made only a cursory examination. I am not the least bit ashamed to say that I was so darned tickled that I grinned all over and felt very much as I did the time I shot my first buck up in the Adirondacks, an occurrence that was immediately recalled to my mind.

Feeling pretty good, I went merrily on my way, thinking that my part of the show was over for the day, but again I was mistaken, for almost immediately another one started to rush me with a vicious-looking trench knife. He was just a bone-headed damn-fool, for I had him covered all the time and ordered him to halt twice. It is true there was considerable noise and I did not strain my voice, yet he could not have mistaken my intention, which was to make him my own little prisoner. However, he kept on coming, so I let him have it. Hutch would say I was a damn poor shot, for I aimed at his stomach, but really hit him above the heart and at ten feet that is not very good shooting, but it did the trick. He fell over backward like he had been hit by an axe, for that Colt has a terrible wallop with the extra heavy ammunition we use over here and I was really amazed at the result. But here is really the interesting part. When I looked this bird over, imagine my surprise to discover the figure 7* on his shoulder-loop. Gosh! I almost yelled with delight, and, although against intelligence regulations, I could not resist the temptation to rip off one of the loops on which the magic figure was embroidered in red, and I think I shall send it to the new Company I as a souvenir of the occasion. So at last I have two notches in my gun. Altogether that makes three of those pups I am *sure* I have to my credit, one each for you and one for myself. The fourth I feel pretty sure of, but I didn't actually see him because he seemed to fall in the trench. The first two you will recall I mentioned in a letter either to you or Hutch, as having gotten from a sniping-post last winter when I was with the Guards. Should they by any chance bump me off now, I will at least have the satisfaction of knowing that the ratio is three to one in my favor.

I simply can't find time to repeat all this junk in a letter to Hutch, and knowing how his blood-thirsty soul will envy me my opportunity, won't you please tell him about it, and be sure to tell him that though I frankly acknowledge his superiority over me in the shooting line, I'll be damned if he could do better than get a hundred per cent of hits. Yes, it gets into your blood in time. Last winter I felt the need of a drink when I saw that chap I potted, but this time I felt more like buying a drink for the whole A. E. F. I was so darned well pleased with the luck I had.

Finally I got back to where I had left my kit, got into another pair of breeches, shoes, and puttees and was as happy as a kid on Xmas morning. By noon we had collected about a thousand prisoners at the P. C. and I had a most interesting time in looking them over and talking with the surprisingly large number who spoke English and quite a few others who flattered me by pretending to understand my attempts at French. Really you can't imagine how interesting that was. Also, don't believe all the bunk the papers print about the dilapidated condition and unnourished state of the Boche soldier. He is clothed and shod as well as our men are and particu-

*The writer belonged to the famous Seventh Regiment of the New York National Guard.—Editor.

larly neat and clean in appearance. His food is restricted in variety, of course, but he shows absolutely no indication of not having all he needs to eat. Neither has he many misapprehensions regarding what we have done and are capable of doing in this war. He underestimates our numbers now in France by not very much and he certainly did *not* expect to be mistreated when captured. In fact, all of them were obviously tickled silly to be prisoners and at times when a new batch would arrive at the pen it was just like old home-week, the way they would greet each other, shake hands, and laugh at what they seemed to consider their good fortune.

I must admit that I had the surprise of my life that morning in many things. Our line kept on going and soon the question of traffic became of vital importance. Really, my dears, it beggars description. I simply can't convey to you any idea of the condition of those roads used to supply that rapidly advancing line. Naturally, there were no roads across No Man's Land and the elaborate trench systems on both sides of it, so they had to be built and damned *tout de suite* at that. Building roads under shell-fire is not the pleasantest occupation known to man, but they were built nevertheless, and were soon jammed with more different kinds of vehicles that roll, crawl, and creep than you have ever seen. In my nine months over here I had not seen a lot of those darned queer-looking things before, though I knew most of them by name. It is not difficult for an army to advance, but the biggest job is to supply it and in every bog show the words 'transport' and 'traffic' soon become the things that cause more human anguish, worry, and anxiety than I ever before knew could be packed into two such simple terms. But I could write volumes about that and not begin to scratch the surface of the problem.

Thank God, I managed to realize to a degree the real importance of that prosaic subject that used to bore me nearly to death at the Staff College last winter. Really the whole game of modern warfare is based upon supply, and the things you can feed into the insatiable maw of an army on the move without beginning to satisfy its needs, makes one's brain reel when trying to comprehend it. Producing an army of 5,000,000 men is a cinch compared to keeping it supplied after you once have it, and we had only a small fraction of that number of men engaged in the St. Mihiel show, yet our problems nearly turned my hair white. Incidentally, I am the beneficiary of the greatest piece of luck you ever heard of in connection with that traffic situation. I had to go past a cross-roads that was having the far shelled out of it with both H. E. stuff and gas, a nasty combination. Just before I arrived the Major in charge of traffic there was killed by a shell and things were rapidly getting into a damnably confused state. That particular cross-roads was of vital importance to our supply system and I naturally couldn't stand around and see my first little pet battle spoiled in that way, so I took over the job for 18 hours, and for the first time in my life I got some real advantage from an ability to cuss mildly. You know you really can't be a successful traffic cop without a little profanity at your disposal. Of course, having to wear a gas-mask is a bit of a handicap, for it requires you to eat your own words, as it were, and also gives the enraged drivers of all sorts of vehicles a chance to cuss back at you without being court-martialed, but the blue tinge your cussing gives to the atmosphere seems to neutralize the effect of gas. Anyway we managed to keep things moving fairly well past that damned place and the day after my return here I was informed, greatly to my surprise, that I had been made a Lieutenant Colonel. Funny old world. For over a year a lot of people have seriously tried to make me a Major and finally as a great concession their efforts were successful and in less than a month thereafter, just because I spent a few hours having the time of my life thinking up new phrases of profanity while serving my novitiate as a traffic cop, they, with the stroke of a pen, turned my gold leaves to silver. If that poor chap at that cross-roads, whom I knew quite well, and he was a corking officer, had not had the hard luck of being killed, I suppose I would have remained a Major the rest of my military career. Rotten game this and I am beginning to hate it like hell at times, when I think of that phase of it, yet it gets into your blood somehow and in other ways is the most alluring and fascinating occupation one can possibly engage in. I am reeking with rank now and Heaven knows I am not seeking more, I just want to get back with that old bunch for one rip-snorting scrap, for I know what they can do and I want to be with them when they do it. If they will only let me do that, I would promise never to peep again, no matter what job they put me on. But what more can I do? And all the time it worries me nearly sick for fear that some of that crowd may think that I am really not making any effort to get back and that I am quite content to enjoy the privileges and what they probably think are the comforts of my present job. Oh! if they could only know how I feel.

I had to stop here rather abruptly and start for Verdun in connection with another marvelous show that began on the morning of September 26. I have just returned to get some more things to wear and am off again this afternoon to another part of the front. Of course, you are reading all about what is going on over here at present. I could write you volumes about some of the things I have seen during the past ten days, but things are moving too fast to make it possible for me to find the time. I wanted to tell you about the amazing accomplishment of the 3rd battalion of the old Regiment. It's tragic, but wait until you hear from me about it before becoming unduly alarmed. Be careful not to mention this to anyone so as to avoid wild rumors. Just remember that Company I and the other three companies of the battalion will occupy one of the most brilliant pages in the history of this wonderful war. That is not romance, but cold-blooded fact, so much so that I fear you will be shocked and sad if what I believe to be true is verified, yet it is glorious. I don't know when I will be back, so am scribbling these few lines of attempted explanation and will start along. My God! but it is great to be alive, in France and in this war.

Sampling

By F. W. BUNYAN

Introduction. The technical chemist knows from experience how disheartening it is to go through the analysis of material handed to him that he is aware has not been properly sampled and that will therefore, despite the most careful analytical work, only serve to misrepresent the facts. Sampling is the alpha and omega of chemical control and is, if possible, more relatively important than the subsequent analysis. Of what avail is the most excellent superstructure when the foundation is unsatisfactory?

So much has been written on the subject that it is perhaps about threadbare, but it is one of those fundamentals that cannot be too thoroughly emphasized. The chemist is employed as a mechanic of control, and in order to justly and satisfactorily pin the responsibility upon him he ought either to supervise and control the actual sampling or, in those cases where such is genuinely not feasible, have the assurance that it is carried out to his personal satisfaction. To attempt to make a man responsible under any other conditions is alike foolish and unjust, and, in extreme cases, it may be almost criminal in its results. Where, however, proper sampling conditions exist the responsibility can be definitely fixed, to the mutual satisfaction and peace of mind of all concerned. Sometimes jealousy or, it may be, tender corns stand in the way, but either efficiency on a basis of justice is aimed at, or it is not.

H. C. Hoover* treats the subject briefly from the mine-valuer's standpoint. Bauer touches an altogether different phase and gives one or two interesting instances. To those handling iron and steel the whole first half of this book will well repay study.

In a well organized enterprise, such as a large mine, smelter, or steel plant, the value of systematic sampling is generally appreciated, but speaking of the industries as a whole the common indifference to the importance of sampling, and to meticulous exactness in performing it, is nothing less than amazing.

The best book so far encountered dealing in any detail with the subject of mineral sampling is Rickard's 'Sampling and Estimation of Ore in a Mine.' This work is particularly valuable as including the written discussion of various phases and the different experiences of no less than 25 well-known men. Even to the man who is not brought into everyday contact with the mine there is much that is suggestive and that will well repay careful study.

I have wondered if we shall, in the more intensive development of the future, see a chair established in some one of the universities to deal with the question of sampling; certainly its financial importance would well justify it, whereas at present it hardly figures in the curriculum. How many mines, particularly gold mines, have been over-capitalized and later shut-down as an almost total loss, apart from any question of knavery, on account of no other thing than inefficient sampling.

An Example. To turn to a specific case, namely, the sampling of a magnesite ore, and touching first, briefly, the theory of the matter: the specific gravities of the chief constituents are:

Mineral and formula	Specific gravity
Magnesite, $MgCO_3$	3.0
Silica, SiO_2	2.3 to 2.6
Serpentine, $Mg_3H_4Si_2O_9$	2.5 to 2.6
Calcite, $CaCO_3$	2.7
Dolomite, $Mg:Ca(CO_3)_2$	2.8

The last four constitute the principal foreign ingredients or impurities. The contract for purchase usually specifies the maximum of silica and lime, and the market-value of the ore commonly varies according to the extent that these two are relatively absent. Silica and lime, then, are the factors of prime interest. The pulp as prepared for analysis all passed a 100-mesh screen.

On this basis, assuming for argument the mean diameter of the particles to be 1/200 inch = 1/200 × 1000/40 mm. approximately = $\frac{1}{8}$ mm. diam. = 1/512 mm.^{3}, or, say, 1/500 mm.^{3}

If the sp. gr. be 3, then 166,666 such particles weigh one gramme, and taking 2.6 as the mean sp. gr. of the impurities, then likewise 192,309 such particles weigh one gramme.

Taking now, for illustration, an ore containing a total of 8% of all impurities, 1 gramme contains (92/100) × 166,666 particles $MgCO_3$ = 153,332, and (8/100) × 192,309 particles impurities = 15,384.

Then by Poisson's formula the limit of sampling-error is $\sqrt{\frac{8 \times 15,384 \times 153,332}{168,716}} \cdot 334$ = a variation of 2.17% on 15,384.

Applying this to the impurities, 2.17% of 8% = 0.17%, that is, the limit of sampling-error is 8 ± 0.17%, that is, between 7.83 and 8.17%.

Taking another illustration, an ore containing a total of 4% of all impurities and calculating by Poisson's formula, the limit of sampling-error comes out as 3.15% of 4% = 0.126%, that is, the limit of sampling-error is 4 ± 0.126% = between 3.87 and 4.13%.

In either case these limits are maxima; the mean variation will be approximately one fourth of the limit; in the cases quoted it would range between 7.96 and 8.04%, and from 3.97 to 4.03%.

The conclusion is that, so far as the pulp (100-mesh) is concerned, the error is within workable limits so long

*'Principles of Mining': (1909) pp. 4-11. 'Sampling and Analysis of Iron and Steel': Bauer and Deiss (1915), English translation by Hale and Williams.

as every precaution is taken by the sampler in handling his machines and in keeping them clean, in dividing and quartering, and in mixing. The importance of scrupulous and rigid care in mixing in order to obtain the most nearly homogeneous mixture that the degree of fineness of the pulp will permit cannot be too strongly emphasized.

There is one more point that has to be watched in the laboratory, particularly in the case of samples that have been lying by or that have come by post, and that is the tendency to segregate. Every chemist is aware, for example, in the case of samples of pig-iron, of the tendency, if the drillings have lain by for a day or two or have been shaken, for the graphite to separate out and come to the surface, and of the totally misleading analyses that can in this way be obtained if not guarded against by careful mixing. Similarly many minerals have this tendency, in a less degree but sufficiently to affect analyses, as, for instance, where there is any marked difference in hardness as between magnesite and silica, or where one of the ingredients is present in the form of small round polished crystals, such as spinel, ilmenite, or magnetite, which are generally present in the Californian magnesite and have this tendency to separate.

Crude Material. To pass now to bulk-sampling, or the selection of the actual sample, in the magnesite example, unusual difficulties were experienced for a variety of reasons. The magnesite was bought from various local mining companies, calcined in rotary kilns, and the bulk shipped to the East for refractory purposes under a strict specification. Three of the supply companies we will call X, Y, and Z, taking the X people first, as on the experience gained with them the subsequent modus operandi was based.

I was analyst and works chemist to the purchasers, and the X company commenced their deliveries on the same day when I entered on my duties. They seem previously to have been getting out a really good grade of ore, but unfortunately at this particular moment they struck a silicious lens in the midst of their main orebody. Some loads shipped to our plant looked high-grade to the eye but on breaking them with a sledge-hammer they showed a crystalline quartz nucleus that, while interesting enough from the mineralogical point of view, rendered the stuff practically unmarketable. One casual grab-sample showed as high as 24% silica, whereas 4% was the topmost limit, such material being purchased only under protest.

Grab-sampling had been customary up to this time. That is to say, the sampler went over the dump representing the day's delivery and selected therefrom something like 30 pounds of what he considered to represent the pile. The sampler was a conscientious employee, but he took an interest, too much interest, in his work. Knowing that silica was commencing to give trouble, and being instructed to keep his weather eye on the matter, it is not surprising that, making his grab, he regarded the more silicious portions with a liberal but by no means friendly eye, grabbed such, and the results on analysis may be imagined.

Dispute followed dispute: counter-samples and umpire-samples were taken; they were taken interestedly, if unintentionally, with the result that some most diverting variations came to light and some rather heated arguments ensued. Analyses were checked and re-checked, umpire-analyses made, and the whole matter generally turned inside out, but the analyses stood. On the mode of sampling employed, the X company could not get behind our findings.

Analysis of the following three deliveries, as usual, was based on grab-sampling, and was disputed.

Number	Date	Tons	SiO_2 %	CaO %
82	August 19	31	4.76	2.37
92	" 20	28	4.56	3.22
98	" 21	23	5.36	2.92

This, on a tonnage basis, gives a mean silica percentage of 4.86.

An analysis of admittedly culled stuff from this dump ran as high as 7.72% silica, and a grab sample of sufficient bulk to run through one of the main jaw-crushers gave a silica content of 5.24%. The point is, that in all this 'sampling' the human equation entered, and there the trouble lay.

On August 22 a further delivery of 34 tons of what was stated to be the same grade of ore from the same stope was delivered, and on mutual understanding this was bulked with the 82 tons above, the whole dump of 116 tons being run through the crusher and an elevator-head sample thus obtained. This gave the following:

Number	Date	Tons	SiO_2 %	CaO %
102	August 22	116	4.38	2.70

This result was manifestly fair and was accepted by both sides. Although the silica content came out materially over the contract limit of 4%, a concession was made and the ore accepted and certified on the 4.38% found.

On August 19 this company had delivered on the switch a car of specially high-grade stuff from their best stope, with the idea of bringing, on a tonnage basis, the silica content of the material in dispute well under the 4% mark. We were notified, and hoped the matter would prove so, as at the moment we were rather overloaded with high-silica stuff. The car was dumped, the usual grab-sample taken, and to the general disgust the silica came out as high as 7.44%. The umpire called in by the X company found 7.35% silica on the same pulp, confirming our finding up to the hilt. Matters had now reached a deadlock: if the ore ran to this figure and persisted, it was unmarketable, and nothing remained but to shut-down the mine.

We were not inclined to pass this carload through the crushers, because that would mean its going on through the kilns, but to settle the matter finally one way or the other to our mutual satisfaction it was arranged to sample by driving into the centre of this dump and taking out 16 wheelbarrows, the contents of these to be passed through the crusher and a shovelful taken every

two minutes at the elevator-head above the crusher, this to constitute the sample and to be quartered and reduced to pulp in the usual way.

Work was started when the night-shift came on, and as the matter was urgent and outstanding, I remained on duty and supervised the operation until the sampling was through and the pulp available and then made the analysis for silica forthwith, that being the deciding factor. The sample was run in triplicate, the three results being 3.80, 3.84, and 3.88%, respectively, giving a mean of 3.84%. The day of grab-sampling at the plant was gone!

It is only fair to add here, by way of comment, that where the ore is of an even grade, but more especially in the case of high-grade ores, grab-sampling may give satisfactory results for the simple and obvious reason that its evenness largely precludes any alarming variation. So far as I am concerned, however, I would not be a party to grab-sampling nor to any system of buying based upon such methods.

Smiling peace now reigned with the X people, but red war broke out with the Y: our troubles were like a miniature Gallic war; no sooner was one group of natives quelled than another rose in arms.

In consequence of the preceding experience we had cut out grab-sampling and substituted a system of fair or representative sampling on the following basis: The Y company delivered about two-thirds of their material in auto-trucks and the remainder in team-wagons. The load was by no means constant and in extreme cases would vary from two to four tons, but would average about two tons and a half. The Z company delivered all their ore in cars on the switch, and a car would vary from as low as 40 tons to as high as 66.

The Y company at this time was delivering an average of about 22½ tons per day, or, say, about nine loads. A wheelbarrow sample was now taken from each load during the course of unloading, and was emptied into a bin constructed for the purpose. The first thing the night-shift did when they came on was to put the day's sample—averaging for the Y company some nine barrow-loads—through the crusher, a shovelful being taken out every two minutes by a man kept at one of the elevator-heads for the purpose. The shovelful was collected as the elevator-bucket turned over and emptied itself, and so contained its normal proportion of fine. The shovelfuls were quartered and treated in the usual way, special care being taken in the matter of mixing and quartering.

Such is, unquestionably, a fairer system of sampling than that previously in vogue, where the human and interested agent selected *what seemed to him* a representative sample, a few pieces in a small tin bucket like a lunch-pail, some 30 pounds to represent as many tons. Reading the matter in type it seems almost too ludicrous for words, and the wonder is that men gifted with ordinary common-sense, to say nothing of considerable mining or business experience, tolerated such an anomalous and absurd state of things for a moment. With the new system and a daily delivery of nine loads yielding nine wheelbarrows of about 150 lb. each the sample would weigh some 1300 to 1400 lb., and of this the portion mechanically obtained at the elevator-head without partiality, favor, or affection, was some 150 to 200 pounds.

Apart from any question of strong mind or strong right arm, the grab system was favorable to either buyer or seller according to which did the 'sampling', for I contend that impartiality under such conditions, especially when you are working close to the market's edge, is a practical impossibility, and the more so as the sampler has knowledge of or interest in the matter. The only objection I know of or that has been raised against the barrow system is that it is not absolutely fair or reliable unless it is carried out on a tonnage basis. This objection I had to grant, and as soon as it was raised I took immediate steps to remedy it, so as to have the work both theoretically and practically as near perfect as circumstances would permit. I defy anybody to show a materially better method, apart from the use of an automatic sampler, that is practicable within the requirements and conditions of everyday work, and difficulties in connection with our yard accommodation made an automatic sampler rather difficult for us to install.

The bone of contention is usually over 'fines', for reasons that will be obvious on consideration of the table of specific gravities already given, coupled with the fact particularly noticeable in the case of the serpentinous grades, which are softer, of the results of abrasion and the apparent readiness with which the more silicious material comes away as dust from the magnesite matrix. Difficulty arises from the use of chutes, especially where the sides are not lined, and some of the wall-material is brought down also. It has been repeatedly objected: "Why, the stope-analysis shows so much, and yet with material almost exclusively from this very stope you are showing so much per cent excess of silica." I refused early to accept the onus of an explanation; it rested with the other side. Let the objector keep side-wall material out of the ore and watch his miners (who are generally on a tonnage basis) that they get out ore only, and this difficulty will cease. Instead of the onus being at the plant it is at the mine, for it is up to the management there to maintain discipline and efficiency, and not to pay for a service or tonnage they do not actually get. To expect the purchaser to pay for, or to explain, inefficiency at the mine is ridiculous in the extreme, and the analysis of ore in the stopes is only dust in the eyes of the blind when the subsequent history of the material is not kept strictly in harmony.

But to return. In the case of the Y company the grab-sample had been taken each morning from the previous day's dump by an employee of that company in conjunction with our sampler, and while the Y boy was neither unreasonable nor intentionally unfair and also was on good terms with our sampler, yet the two of them were not mechanical—they were human. Thus sampling with them was a matter of opinion. Their lad would take what he considered fair, our man would make any objection, if he had any, and would add perhaps a little more of obviously silicious stuff or of green serpentinous ma-

terial if present. They would agree by consent, and thus the 'sample' was obtained.

One fair morning the Syrian came down like a wolf on the fold and we had a pitched battle, the Y and Z people having formed an offensive and defensive alliance for the occasion. The outcome was that the Y people proposed another system of sampling, which, when faithfully carried out, has the virtue of eliminating the human equation, but yet does not yield a fair sample, as it takes no account of the fine, which, in truck-hauling, often sinks in appreciable quantity to the floor. It is a method of surficial sampling, and subject to all the faults inherent. It consists in throwing a net over the surface of each truck-load, and at each point where a knot falls to take a chip of approximately uniform size and to take approximately one pound per ton from each truck. Among other objections, it is too small in bulk to be acceptable. As to a pro rata basis, this yielded one pound per ton, or 0.05% of the bulk, whereas our mode with the wheelbarrows gave (as above) approximately from 1300 to 1400 lb. on the day's delivery of some 22½ tons, or at the rate of some 3% of the bulk. Mathematically, on this basis the odds were at least 60:1 in favor of our method.

For 18 deliveries the material was sampled by both methods and the following table gives the results (silica only) for comparison. It will be noted that in six cases the net method gives the higher results, in the other twelve the wheelbarrow is highest. This has no direct bearing on the correctness of either method, but in view of the remarks above, as to the fine, it is at any rate significant.

Number	Tons	Barrow %	Net %
187–188	41	3.86	4.78
192–193	70	4.26	4.04
200–201	79	4.50	4.68
206–207	54	5.06	4.76
215–216	49	3.92	3.34
218–219	59	5.96	5.72
222–223	24	4.38	2.78
227–228	40	5.10	3.26
233–234	81	4.32	4.68
239–240	47	2.68	3.18
241–242	33	5.30	4.00
249–250	65	5.16	3.54
255–256	31	5.08	4.64
266–267	11	3.72	5.00
270–271	29	5.57	3.90
278–279	57	3.14	3.28
282–283	32	5.04	3.90
294–295	23	3.70	2.30
Total to tonnage basis	825	3709.51	3389.83
Mean of 18 deliveries on tonnage basis		4.50	4.11

Mean difference on long average of 825 tons = 0.39%

We have stuck to our point and method, and its fairness and impartiality have come to be recognized.

We went through much the same set of difficulties with the Z people, modified by the special circumstances resultant on their mode of delivery. They were delivering on the rail in carloads of from 40 to 65 or 66 tons as already described. In their case the material passed through several hundred feet of chute before reaching the car, and while it was pretty well blended in its passage, yet it gained at times no small amount of foreign matter through abrasion of the walls. There is also another difficulty, periodical and seemingly unavoidable, that the chute system involves, at any rate in the case of magnesite ore and ores of a similar type, namely, the fine gathers at points in the chute until it reaches a certain volume, then the normal movement of ore starts it going and an avalanche of fine ensues. This comes down along with the normal ore-feed, and for from three to five cars the amount of fine is excessive and the percentage of silica rises accordingly. Under such conditions a grab, or any form of surface sampling, is totally inadequate, because, owing to the difficulties peculiar to loading, some of the cars come surfaced with high-grade lumps, whereas others are surfaced with nothing but fine. There is no question of 'topping' or tricks of the trade, but the conditions are such that surficial sampling is worthless: it may do with an occasional car, but car in and car out it is worthless.

The following table gives analyses of six different cars sampled, for purposes of comparison, in the two following ways, the first or pick method being in common use among miners and being at the time strongly advocated by the mine manager concerned.

First: An ordinary prospecting pick is taken and the car gone over from one end to the other, measuring time

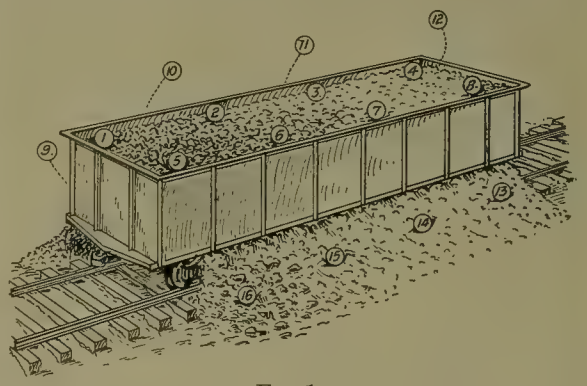


FIG. 1

after time twice the length of the pick handle and, at the place where the point of the pick falls, knocking a chip the size of the top joint of one's thumb off the lump, or, if fine, taking a good pinch of corresponding bulk. When the end of the car is reached, twice the length of the pick-handle is measured off in a side direction and a bee-line made from this point to the first end of the car, similar to that already done, carrying out the chipping process as before at every two pick-lengths. When the whole car has thus been gone over lengthways the process is repeated, but this time from side to side. In this way about 30 pounds of a fair sample of the surface of the car is obtained, but it is only a surficial sample—anything may be underneath.

Second: Sixteen wheelbarrows are taken out of the car as shown below in the diagram, eight at regular intervals over the top, four a side, digging well into the material to obtain them, and other eight from the ground, four a side from either side of the car, when the car-bottom is opened for dumping.

This dump method appears to be as just and representative a mode of sampling as can be devised, and is now thoroughly endorsed by the Z company. It may be

added that, with their system of chutes, the ore generally lies in the car with the fine more to one side and lumps to the other, and this is recognized in the dump method, which is as mechanical as possible in view of the circumstances involved.

Number	Tons	Pick %	Dump %
164–166	51	3.73	3.23
205–204	52	3.12	3.20
213–221	50	5.20	3.40
399–412	63	5.10	3.60
402–403	64	3.31	3.60
406–411	60	5.40	2.67
Total to tonnage basis	340	1469.61	1118.53
Mean of six deliveries on tonnage basis		4.32	3.29

Mean difference on long average of 340 tons = 1.03%.

As to the ratio of sample, 16 wheelbarrows represent from one ton and a quarter to one ton and a half, or, say, an average 2½% sample of bulk, as against some 30 lb., or, say, 0.025% of bulk.

Regarding ore and commercial sampling as a whole, there is in my laboratory a 'sample' weighing rather less than an ounce and a quarter. Almost all orebodies that I have seen are non-homogeneous, but magnesite is especially heterogeneous. In view of this fact and the remarks supported by figures at the commencement of this article as to the need for a sufficiently large number of particles, or correspondingly of pieces if they run large, I think the commercial valuelessness of an analysis of such a small sample, and the folly of the practice, will be evident.

CHEMICAL CONTROL is a serious item of expenditure, and such control either exists or it does not. In many cases, not necessarily limited to magnesite, it is so set off by faulty sampling as to be little better than a farce. As a case in point: the superintendent of another plant recently complained to me that he could not understand the silica question, it was a mystery to him. The material that passes through his kilns "grows" (to use his wistful expression) something like 1% SiO_2 in the process of calcining: if it enters 2% crude, it comes out calcined 5%.

Now the CO_2 content of chemically pure $MgCO_3$ is, from the formula, 52%. The ignition loss on a standard sample of magnesite ore (pulp) we make use of for purposes of standardizing and comparison is 48%. On this 48% basis 100 tons of ore should calcine to 52 tons product. In practice there is a loss due to discrepancies in weighing, dust removed in the dust-chambers (silicious dust), dust carried to the atmosphere through the smoke-stacks, loss of alkali through volatilization at the high kiln-temperatures, so that over a long average it requires 2.19 tons crude ore to produce 1 ton of calcined material, or 100 tons yield 46 tons of product.

On this basis 2% crude should calcine to 4.38%. Assuming, however, that on a day's run of 150 tons some 5 tons of 12% silicious dust has been taken out by the dust-chamber, this means a loss of actual silica of 0.60 ton, which is equal on a percentage basis to a loss of 0.40% SiO_2 on the crude. This, as a practical man will see at a glance, will vary with the silicious content of the crude, and seeing that we are discussing high-grade stuff (2%) we can afford to cut the figure in half. We are still left with a loss of 0.20% SiO_2, that is, our 2% material should calcine to $4.38 - (0.20 \times 2.19) = 3.94\%$, or, say, in round numbers, 4% SiO_2, and if it does not the fault lies with the sampling. It is scarcely probable the chemist is in error in such a case, his error on a long average is likely to pretty well cancel itself, and further, any error in the analysis of the crude would tend to cancel itself or be disguised by repetition in the case of the calcined, and thus pass undetected.

Sampling of the calcined ore presents its own problems. The material is kept under check by analysis as it goes to the cooling-floors and finally as it is loaded into the cars for shipment. All the loading is done by wheelbarrows, but an elevator system with mechanical sampler is advisable and is indispensable in the design of an improved plant.

A mix is effected by combining the running of the kilns, such that the mixture on the cooling-floors will just hit the specification desired. In addition to the mixing incidental to the process of crushing, a further blending occurs in each of the kilns owing to the rotary motion during calcining, followed by the movement up the runways, the fall from the cooling-tower, and descent to the floor. Despite all this, grab-sampling taken on the floor or at the kilns shows surprising variations, and grab-sampling gives no more consistent results here than it does in the case of crude.

Originally, cars for shipment were sampled by taking out some 30 pounds or less in two stages during the loading of the car. This 'sample' was the usual gamble based on the personal judgment of the sampler, and the 30 lb. had to represent a carload of some 50 tons. This was changed to getting out a total of two wheelbarrow loads at three or four stages during loading, when the car was respectively one-quarter, one-half, three-quarters full, and finally completed. This was an improvement, but it was still possible to obtain two samples from the same car that showed excessive variation.

This was changed to taking a shovel out of each wheelbarrow as it goes to the car for loading. This gives the longest average and the fairest distribution of error that it is perhaps possible to obtain outside a mechanical sampler; in fact, from the standpoint of experience it is doubtful if even a mechanical sampler would do better. The following six analyses are of cars that were sampled recently for comparison by the two methods. In either case (A) is the four-stage method mentioned in the preceding paragraph, and (B) the long-average method described in this paragraph.

	Ignition loss %	SiO_2 %	CaO %	R_2O_3 %	MgO %	Total %
(A)	4.26	4.84	3.28	1.36	85.45	99.19
(B)	4.46	5.80	4.04	1.56	85.02	100.88
(A)	1.94	6.08	3.64	1.52	85.60	98.78
(B)	1.92	6.16	4.00	1.40	86.32	99.80
(A)	2.28	6.00	3.58	1.92	86.22	100.00
(B)	2.88	5.68	4.14	1.72	85.58	100.00

Various reports reached us as to the methods of sampling in vogue in the East, and we were rather unwilling to give them credence on account of the extraordinary laxity shown. However, the matter was confirmed in conversation with one of the Eastern buyers recently at the plant, and one has a feeling of hardship in knowing that

after all the scrupulous care that has been exercised at this end in the endeavor to sample fairly, one may be up against some happy-go-lucky hit-or-miss method at the other end.

Careful quantitative investigation at the plant has shown that magnesite after being calcined but not actually sintered takes up both water and CO_2 along a regular curve. In the case of sintered magnesite the take-up is practically negligible. Specimens of calcined material are mailed out in two-ounce bottles, pulp or granulated, carefully quartered from a large bulk, the cork and neck of the bottle being hermetically sealed by dipping in melted paraffin wax, and the whole then enclosed in a four-ounce mailing-tube.

While the above was in the Editor's hands I had further experience along the via dolorosa, this time with manganese ore (pyrolusite). Out of some dozens of instances that might be tabulated the following two illuminating cases are quoted, being the two most recent at the time of writing. They represent two distinct carloads from different mines and localities, loaded differently, hence there should be, and is, a call for special care in the crucial matter of sampling. A little thought will convince that one fundamental radical sample would be a material economy both as to unnecessary labor, wasted time, uncertainty and expense, than three botched attempts, for the three botched attempts merely serve to make trouble. Analyses are by me save where otherwise stated.

1. A box-car, apparently loaded at the mine from a chute that was diverted from one end of the car to the other during loading process, the ore in consequence

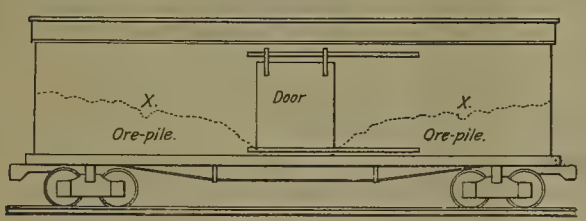


Fig. 2

lying as shown in Fig. 2, which represents a longitudinal section.

This car was actually sampled four times—once by the vendor, and three times at the smelter! Sample A is the vendor's: in B the 'sampling' was from the surface and taken by the regular sampler as fairly as working-conditions permitted: in C a good hole was dug at the two points marked x and a substantial sample removed in a wheelbarrow; D is what is here termed an 'unloading' sample and is obtained after the material has passed through the crusher, one shovelful being taken from each car on its way up to the bins. The bulk of A, the vendor's sample, is not known, so that its factor cannot be argued on: the bulk of B is 120 lb., or about 0.12% of total: the bulk of C and D is practically the same—one wheelbarrow—something like 0.2% of the bulk, and well distributed, thus considerably augmenting the mathematical difference in the factor of safety.

	A	B	C	D
	%	%	%	%
Manganese	41.15	39.90	34.77	36.60
Silica	17.20	16.18	31.62	30.74

Samples C and D carried fine, whereas B was practically fine-free: by comparison of results it would appear that A also was free from fine stuff.

2. An open flat car: A is practically a surface sample, B is an unloading sample similar to D above.

	A	B
	%	%
Manganese	39.16	44.41
Silica	34.64	25.92

3. The following was taken a week or two before my arrival at the plant, and is given as a further instance of variation in three samplings. The method employed in the various cases is not recorded.

	A	B	C
	%	%	%
Manganese	32.50	43.85	31.49
Silica	38.95	23.54	34.70

There is something rotten in the state of Denmark! What basis does this solemn farce give for metallurgical calculations? Such a state of things is mingled gambling and child's play, and is innocent alike of calculation, method, or exactness. Metallurgy is a peculiarly sensitive process, or combination of processes, and the results should be closely quantitative. To work to such a thing as a close slag-eutectic is impossible under the conditions outlined, rather, in the language of Kipling, you're "thankful you're living and trust to your luck."

Dealing with the silica in case No. 1 above, the obvious limit of sampling-error varies between a maximum of 15.44% and a minimum of 6.77% respectively of the total. Or for emphasis, if the finding (16.18% SiO_2) in sample B were correct, then the sampling error in C in terms of SiO_2 amounts to no less than 95.4%. Further comment is unnecessary.

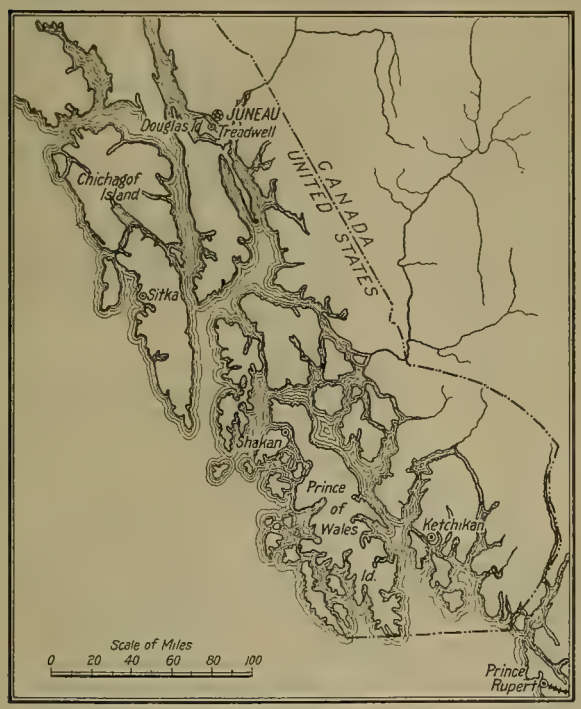
On such a crazy foundation accurate and expensive analyses are performed and scientific control is supposed de facto to exist. When will the prime importance of sampling come to be fully recognized, or are we to continue forever to "trust to our luck"?

The greatest depth at which mining is now done on the Rand is 5634 feet vertical, equal to sea-level. These workings are on the main incline from the Turf Mines shaft of the Village Deep. The South African 'Mining Journal' says that "all the natural obstacles to working at this depth have been successfully overcome. The rock pressure proved the chief trouble, but this has been met by the special methods of support adopted. The increased heat has likewise been offset by adequate ventilation. In regard to the value of the ore exposed in development at this depth it is interesting to note that it is said to justify the favorable anticipations by H. F. Marriott, recently published. Another feature is the fact that the improved Whiting hoists have worked most satisfactorily, thus considerably simplifying the problem of winding at great depths."

JUNEAU, ALASKA

Physical and Financial Condition of the Alaska Treadwell and Alaska Juneau Properties.

Another report of F. W. Bradley, president of the Alaska Treadwell, Alaska Mexican, and Alaska United gold mining companies, has just been issued. As is generally known, the Treadwell, Mexican, and 700-Ft. Claim mines were flooded



MAP SHOWING SITUATION OF THE SHAKAN MOLYBDENITE MINE, PRINCE OF WALES ISLAND, AND TREADWELL, DOUGLAS ISLAND

by the sea on April 21, 1917, since when only the Ready Bullion mine has been worked. All of its openings beyond the shore-line are under the deep waters of Gastineau channel. All openings are being filled in order to make the mine safe. This has cost $120,000, to prepare for the filling, while it will cost 15c. per ton to secure rock and dump it underground. The shaft is down 2800 ft., and cross-cutting is in progress. Ore-reserves above 2600 ft., plus the probable above 2800 ft., total 2,300,000 tons, of which 1,400,000 tons will be recovered. If pay-ore is found at 2800 ft. sinking will be continued to 3400 ft., the limit of the present hoist. If the bottom turns out profitable, driving west will be continued to prospect at depth any extension of the Treadwell-700-Mexican orebodies. If sufficient is then found, high tides will be dammed from the break on the shore of Gastineau channel, the old workings pumped out, and mining conducted through the Combination shaft, which is in solid ground. This would be in 5 to 10 years' time.

During the 9 months ended September 30, 1918, the Ready Bullion mill treated 328,990 tons yielding $724,686. The cost was $826,819, including $54,692 for shaft-sinking and shaft-house, etc., and $126,429 for safeguarding the mine against salt-water leaks.

Financial statements for the three companies during 1917 and the first half of 1918 may be summarized as under:

	Alaska Treadwell	Alaska Mexican	Alaska United
Receipts in 1917	$2,370,800	$212,924	$771,554
Expenses in 1917	1,999,179	149,680	861,789
Final excess of receipts	371,621	63,243	.....
Final excess of expenses	.....	.....	90,235
Receipts, half of 1918	441,719	35,033	190,499
Expenses, half of 1918	418,006	37,934	284,622
Final excess of receipts	23,712	.....	.....
Final excess of expenses	.....	2,900	94,123

The Treadwell company's mercantile business made a profit of $76,755 in 1917, and $23,207 in the first half of the current year. Supplies are valued at $538,039. Dismantling and marketing saleable equipment up to June 30, 1918, amounted to a profit of $294,398. There is still $209,950 of material available.

A 2-ton Heroult electric furnace was erected at the foundry for making steel castings; also for making ferro-molybdenum from the company's Shakan mine, and probably for making ferro-chrome and ferro-tungsten from Alaskan ores. The Shakan mine is on Prince of Wales island, B. C., and contains 100,000 tons of ore. Detailed reference will be made to this property in another issue of this journal.

In a report dated November 23, 1918, F. W. Bradley gives some interesting information concerning the Alaska Juneau property:

As far as the mine is concerned, there have been no changes for the better or for the worse since the publication of the company's official statement of April 2, 1915; but we have been in trouble with the new mill, which, as stated in the last annual report to the stockholders, has at its best been able to accomplish less than one-half of its promised capacity at an operating cost per ton of over twice the expected cost.

This mill, as originally designed and erected, contained many experimental features that have turned out to be unsuitable for Alaska Juneau ore, and we have been struggling with the problem of how to make the most advantageous use of the mill. With no funds and a shortage of labor, the solution of this problem has been slow and difficult; but work is now under way on definite plans for so altering the mill as to reduce its operating cost to a figure comparable with other milling costs in the Juneau district, also for enlarging the mill so as to bring its daily capacity up to 8000 tons of ore as originally promised. It is estimated that these alterations and enlargements can be carried out at a further expenditure of not to exceed $500,000, in accordance with the program herewith submitted; and that when completed, the property can then earn an operating profit of $1,400,000 per year as originally estimated.

At the time the mill started, on March 31, 1917, all the company's funds had been expended, and there was an indebtedness of $141,226. At the end of 1917, this had increased to $1,015,934, with the progress accomplished as stated in the last annual report. Since January 1, 1918, in-

cluding October (estimated), results have been as under:

Month	Tons	Gold assay-value, cents	Recovery %	Gold recovered including absorption clean-up	Milling costs cents
January	118,809	69.52	75	$61,905	43
February	97,156	68.51	75	49,790	53
March	56,222	82.36	79	36,749	65
April	54,147	72.27	78	30,398	57
May	57,865	71.09	78	32,088	52
June	22,740	104.21	82	31,205	100
July	23,226	186.30	87	47,335	97
August	23,441	143.60	85	29,176	101
September	21,045	132.85	85	23,851	117
October	24,210	113.00	80	34,210	87
Totals and averages	498,861	86.50	79.5	$376,707	63

The corresponding figures for the entire year of 1917 are: 672,424 tons, 87.50 cents, 74%, $470,534, and 56.11 cents.

Of the gold recovered in the above 10 months of this year, $33,567 came from the absorption clean-up and should properly be apportioned to the tonnage crushed in 1917.

The lead and silver value is not included, as it is practically offset by the freight and treatment charges on the concentrate.

Mining and tramming costs this year averaged 38c. per ton, milling 63c., and other expenses 10.1c., a total of $1.111 per ton. All operations cost $554,549, plus $93,686 at Juneau and $74,664 at San Francisco and New York, making a total of $722,899. Adding the operating losses for 1918, San Francisco and New York, and the Juneau extraordinary charges (including $55,615 for mill, $25,231 for preparatory mining, etc.) to the indebtedness on January 1, 1918, the total owing at October 31 was $1,347,068.

In order to secure the amount still necessary to complete correcting the defects in the milling plant, in order to fund the debt and for other purposes, Mr. Bradley suggested a meeting of the stockholders be called on January 10, 1919, for the purpose of authorizing an issue of $3,500,000 of first-mortgage ten-year 7% gold bonds, to be disposed of as follows: (1) $1,500,000 or so much thereof as may be necessary to be exchanged at par for outstanding obligations and floating indebtedness of the company; (2) $500,000 to be sold at not less than par to bondholders, stockholders, or the public, at such times and in such amounts as may be required in order to complete the alterations and enlargements of the milling plant already planned and now under way; and (3) the balance to remain in the treasury, to be used from time to time as may be required for the following purposes:

As it is thought that it will require two years to place the mine on a paying basis, Mr. Bradley recommends that for the first two years, interest on the outstanding bonds shall be paid in scrip or cash, at the option of the directors. If they determine to pay interest in cash, and the earnings of the property are not sufficient to supply necessary funds, bonds to the extent necessary to supply any deficiency may be sold at par and proceeds used for this purpose. If scrip is used for the purpose of paying interest, it may be exchanged at par for bonds. Sufficient bonds for these purposes shall be set aside. Also said bonds, or so much thereof as may be necessary, shall be subject to sale at par at the discretion of the directors, for the purpose of acquiring additional property, increasing facilities, and providing for possible operating losses during the two-year period estimated for completing alteration and enlargement of milling plant, and placing the property on the operating earning basis originally estimated.

With the end of the War, there has been an increase in the supply of common labor in the Juneau district, and it is reasonable to expect a sufficient increase in the supply of skilled men to complete the milling plant in two years' time after the necessary money for the work has been secured. Therefore, it would seem safe to provide for a sinking-fund to commence at the end of five years or sooner, at the option of the company. Also it would seem advisable to provide for redemption of the bonds at any time at the option of the company upon payment of par and 10% premium.

CRIPPLE CREEK, COLORADO

Orebodies Found by Work From the Drainage-Tunnel.—Cresson has Another Large Shoot.

Another important discovery has been made in the property of the Portland company on Battle mountain at the Roosevelt tunnel, at a point 1800 ft. from the main opening, a distance of 130 ft. north-west of the Portland No. 2 shaft, an approximate depth from surface of 2100 ft. The cross-cut being extended to connect with the shaft passed through the Lee No. 5 vein of the Hidden Treasure system. Samples assay from 3 to 6 oz. per ton. The shaft is now within 30 ft. of the tunnel-level, at this point 2137 ft. in depth, and an elevation of 8107 ft. The elevation at the collar of No. 2 is 10,244 ft. Five distinct orebodies have now been opened at the tunnel-level; two in the Cresson on Raven hill, two in the Portland, and one in the Rose Nicol.

The Reva Gold Mining Co., operating the Rose Nicol, in the past week made an important development at the eighth or 1000-ft. level of the Rose Nicol shaft. A vein 10 ft. wide has been exposed by cross-cut, and mine samples show an average of 1 oz. per ton.

The Cresson company reports another important strike in stope 1105, above the tenth level, where ore is now being broken 10 ft. wide and 60 ft. long, carrying $40 to $50 per ton. When the stope was first opened the orebody was 20 ft. wide, but pinched to a narrow streak of less than 3 ft.; but has again grown to large dimension, at a point 28 ft. below the 9th level in virgin ground above. The company now has 30 machines at work; the labor shortage due to the influenza is showing improvement.

The November production from the United Gold Mines Trail and W. P. H. mines totaled close to 1000 tons of $25 ore. One car from the Wild Horse dump returned $15 per ton.

TONOPAH, NEVADA

Recent Developments in the Divide District.

Ore shipments from the Tonopah Divide mine to the Goldfield Consolidated mill have been increased to 300 tons weekly. It averages $30 per ton, and settlement is made on a basis of 92% extraction. A. I. D'Arcy, the consulting engineer, places an estimate on the ore-dump at the shaft at 6000 tons assaying $30. This is based upon continuous sampling during mining. Most of this ore is from the 165-ft. level, and contains molybdite, the yellow oxide of molybdenum. Owing to its excessive cyanide consumption this ore is not being sent to the mill. The molybdenum metal in the ore on and below the 265-ft. level is powellite, a calcium molybdate, and is not soluble in cyanide or any alkaline solution. Except for rich seams or pockets, the amount of the metal is small, and no effort has been made to effect its recovery. If it is found on deeper levels in quantity and in sulphide form, a by-product recovery can be made by flotation. Drifts on the three main levels continue in good ore, and Mr. D'Arcy reports greater uniformity of value on the deepest or 370-ft. level than on the levels above. Ore now being sent to the mill is that extracted in blocking the main orebody by means of cross-cuts and raises at 50-ft. intervals at the 265 and 370-ft. levels. The main shaft is being sunk from the 370-ft. level, and for this work an auxiliary electric hoist is used. Rock broken in sinking is dumped from the bucket into cars at the 370-ft. level, and hoisted in the cages. South of the shaft 570 ft., the cross-cut on the 265-ft. level penetrated what is known as the gold vein, from which high-grade gold ore was taken

near the surface during the early period of activity at Goldfield. A drift east on this vein has opened from 2 to 3 ft. of ore assaying $40 to $75 gold, and has reached a cross-fault where the face showed 5 ft. of good ore. This vein has a trend due east, while that of the silver vein is approximately south-east, and surveys point to a junction of the two within the Divide company's ground, near the south-east end-line. The gold vein dips north at an angle flatter than the silver vein, which is nearly upright, and a cross-cut is to be driven to the gold vein on the 370-ft. level. Old workings on the gold vein, at the outcrop, are nearly 100 ft. above the collar of the main Divide shaft.

In the Gold Zone property, adjoining the Divide on the south-east, a drift on the 295-ft. level followed the Divide vein to the joint end-line, where the face sampled $11 per ton. The Gold Zone shaft is being sunk to reach the 500-ft. point.

The Brougher Divide, adjoining the Divide on the north-west, has prospected the main vein for a considerable distance on its 170-ft. level, corresponding in elevation with the 265-ft. level of the Divide, but has found no pay-ore. The shaft is now being sunk another 200 feet.

On the Tonopah Dividend, north-west of the Brougher Divide, cross-cuts have been driven east and west to the two parallel lodes on the 300-ft. level. The company has excellent equipment, has constructed a good road to the property, and has a private telephone line to Tonopah.

The Hasbrouck, in the south-western part of the district, has produced a considerable quantity of shipping ore, and has some ore of good grade in the shaft workings, while the tunnel is said to have cut the main vein.

The East Divide, east of the Gold Zone, is sinking with good equipment. The shaft is down 150 ft., and will be continued to 300 ft. before lateral work is started.

GRAND FORKS, BRITISH COLUMBIA

New Work in Grand Forks and Similkameen Districts.

Recent reports indicate that there has been considerable activity in the Grand Forks and Similkameen districts during the past year. In addition to the extensive development being carried out by the Canada Copper Corporation at Copper Mountain, there are many smaller properties that are promising. Some brief reference to these follows:

The Emma copper property in the Grand Forks division is controlled by the Consolidated M. & S. Co. E. Nordman is superintendent. Work totaling 1704 ft. cost $56,340.——The Rock Candy fluorspar mine in the Grand Forks division, also owned by the Consolidated M. & S. Co., has done 492 ft. of diamond-drilling and some underground work. A boarding-house and office has been erected. A wagon-road was constructed at a cost of $10,000, also ore-bins and an aerial tram, the total representing $25,000. Reduction works having a capacity of 100 tons per day may be erected at the railroad terminal.——The Copper Farm group of copper-silver claims, in the Similkameen division, owned by the Princeton Mining & Development Co. of Princeton, has been doing considerable development during the past season. The daily output is 50 tons. A 3-drill compressor and 150-ton ore-bin are among the plant contemplated.——At the Berlin gold-silver claims of the Inland Mining Co., Paulsen, Grand Forks division, the cost of recent work is placed at $4600.——The Efanjay Gold Mining Co. of Spokane has leased to the Placer Development Co. of Tulameen some placer ground on the Tulameen river on which considerable work has been done chiefly for the recovery of platinum, also gold. A dam, flume, and sluices cost $20,000.——The Mastodon, Dominion, and Pan chromite property, Grand Forks division, has been acquired by the Stewart-Calvert Co., Inc., of Oroville, Washington. Work estimated to have cost $6600 was started last July. Eight hundred tons of ore has been shipped.——The Regal group of 10 copper claims, in the Similkameen district, has been developed to some extent, costing $7000. The daily capacity at present is placed at 250 tons.

Victoria.—Sales of Crown-granted mineral claims, in arrears for taxes, are being advertised in different parts of British Columbia. Since the outbreak of war, the regulations in regard to Provincial dues have not been rigorously applied; but from now on the authorities are likely to demand strict compliance with the law. This, of course, does not mean that the terms of the Allied Forces Exemption Act, which protects soldiers, sailors, and their relatives while the former are on active service, are to be cancelled or in any way disregarded.

TORONTO, ONTARIO

Employment for Munition Workers.—Outside Fields.

The munitions industry of Canada, which recently gave employment to 200,000 men and women, has come to an end. All initial work on shells for the Imperial government ceased on November 15, and the processes now in hand must be completed by December 14. Some of the plants working on orders for the United States government may continue operations for a short time, but these contracts may soon be cancelled. The problem of transferring the unemployed workers to peaceful industries with the least possible friction or delay is receiving the close attention of the Government. As the result of conferences between members of the Cabinet and the heads of the railroad, steel, and car-building industries, it has been demonstrated that this can easily be accomplished. The railroads are considerably short-handed, and the needed work of maintenance and improvement has been postponed until after the War. Rolling-stock is badly needed, and car-constructing companies are eager to increase their working forces. In fact, nearly all of the important industries are in the same position, so that all the labor released by the closing of the munition plants is being rapidly absorbed. Of the 25,000 munition workers in Toronto, 6000 have already been discharged. Many of the manufacturers are taking up or reverting to other lines of production, and will retain a large proportion of their staffs. The shipbuilding and agricultural-implement industries offer employment to a large number, though usually at considerably lower wages than the men have been receiving for munition work.

The mine-owners of northern Ontario have been requested by the Government to aid in the work of reconstruction by absorbing all the labor they can employ, a rather unnecessary procedure, considering that the operators have all along been anxious to increase their forces. A good many of the men lately employed in the munition plants have already found their way to the mines and been taken on. The shortage of labor was recently estimated at 50% at Porcupine and 10% at Cobalt. This, it is anticipated, will be made good before spring.

Gowganda.—A large body of high-grade ore has been found on the 490-ft. level of the Miller Lake-O'Brien. The vein is 12 in. wide, and is said to carry 4000 oz. of silver per ton. Besides this there is a good width of milling ore.

Kirkland Lake.—The main shaft of the Elliott-Kirkland, now down 500 ft., will be continued to 600 ft., diamond-drilling having shown an increase in the extent of the porphyry formation at that depth.

Boston Creek.—A new vein, 3 ft. wide, carrying tellurides, has been opened on the surface at the Cotter property. The eastern continuation of the Miller Independence vein on this location is being explored by drilling. The vein has been cut at depth, indicating a width of 6 ft., showing visible gold. Some rich ore is being bagged.

ALASKA

Juneau.—Alaska Gastineau in November milled 94,395 tons of ore assaying 96.8 cents per ton. The recovery was 79.55%. This is an improvement in tonnage over October, when it was 75,870 tons. A year ago the quantity was 175,960 tons averaging $1.08 per ton.

Kennecott.—The Kennecott Copper Corporation pays $1 per share on December 31.

ARIZONA

Ajo.—New Cornelia produced 3,264,000 lb. of copper in November, 500,000 lb. below the average. At the meeting of the American Institute of Mining Engineers at San Francisco on December 10, L. D. Ricketts showed moving pictures of all operations of this company.

Bisbee.—Shattuck-Arizona produced 583,655 lb. of copper, 514,125 lb. of lead, 11,296 oz. of silver, and 86 oz. of gold during November.

The Phelps Dodge Corporation has declared distrubitions totaling $8 per share.

Calumet & Arizona yielded 3,898,000 lb. of copper during November, the lowest output of the year by 300,000 lb., excepting in February.

Clifton.—Arizona Copper Co. produced 4,000,000 lb. of metal during November.

Douglas.—The Phelps Dodge properties in November yielded a total of 15,785,011 lb. of copper. The average monthly output for the year is 18,000,000 pounds.

Duncan.—The Goldfield Consolidated company of Nevada has stopped exploration of its Ash Peak property west of this place.

Globe.—Old Dominion produced 2,101,000 lb. of copper in November, lower than usual.

Humboldt.—A 100-ton concentration and flotation plant is to be erected by the Silver Belt Consolidated Mining Co. There is 40,000 tons of good-grade ore on the dump, left from former operations.

Jerome.—The influenza was bad here, there having been over 900 cases and 82 deaths. At present (December 3) the epidemic is well under control and only 7 cases are under treatment, most of these being convalescents from pneumonia.

The Verde Combination is to sink its shafts 200 ft. below the 1080-ft. level. Twelve headings have been run on this level, most of which have exposed ore, the best showing at present is in the station and cross-cut. The report of the manager, David Morgan, for the year ended October 31, 1918, shows that 5039 ft. of work was done at a cost of $16.67 per foot; shaft-sinking—402 ft.—cost $63.91 per foot; station cutting cost $15.54 per cubic yard. Cash assets amount to $183,814.

Ore is still being shipped from the Maintop of the Jerome Verde, but the quality is somewhat inferior to that of a few weeks ago when the copper content ran above 10%. Several stringers of solid chalcocite have been cut, and they are now working on the 7th floor up from the 900-ft. level. Diamond-drilling and exploration near the Maintop orebody are under way, although nothing of note has been exposed.

Although extremely hard ground is being encountered, shaft-sinking at the Grand Island property is proceeding as well as could be expected and a depth of 380 ft. has been reached in the three-compartment shaft. It is intended to sink to the 500-ft. level, from which point a cross-cut will be driven to cut the vein exposed on the 200-ft. level.

Metcalf.—Shannon produced 684,000 lb. of copper in November. This is the lowest return for the year. In January it was 972,000 pounds.

Miami.—Inspiration Consolidated produced 7,500,000 lb. of copper in November. Since the 10,300,000 lb. output in June there has been a steady decline, due to various causes. At the meeting of the American Institute of Mining Engineers at San Francisco on December 10, L. D. Ricketts showed excellent moving pictures of underground and surface operations at the Inspiration and International smelter.

Oatman.—United Eastern pays 7c. per share on December 28. This is equal to $95,410.

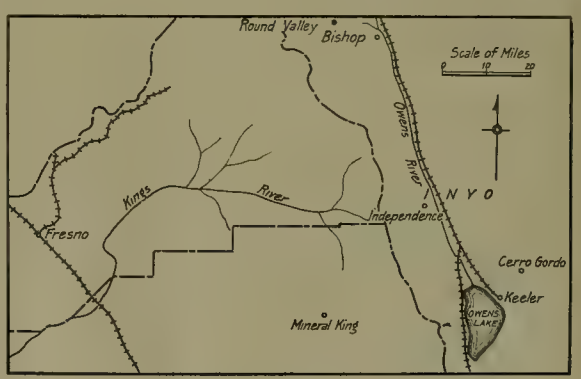
Ray.—On December 31 Ray Consolidated pays 75c. per share, making the 1918 total $3.25. In 1917 the distributions totaled $4.20 per share. Copper output in November was 7,020,000 lb., 300,000 lb. below the average.

ARKANSAS

Yellville.—Zinc mining in northern Arkansas continues fairly busy, in spite of low prices for ore. At the Hawkeye in the Rush district a 500-ton mill has been erected. This produces a high-grade concentrate. Crawford brothers and others of Little Rock and Benton are the principal owners.

CALIFORNIA

Bishop.—Twenty miles from this place, at an elevation of 11,000 ft., is the Pine Creek tungsten mine, according to the 'Bulletin' of the Los Angeles Chamber of Mines and



THE TUNGSTEN DEPOSITS OF INYO, CALIFORNIA, ARE CONTIGUOUS TO BISHOP

Oil. The property is in a region difficult of access. A road was constructed and a 17-mile transmission-line erected. Ore-reserves are estimated at 200,000 tons, averaging

1.34% tungstic oxide. In undertaking to open and equip the property, it was necessary to carry out the following: opening the mine by tunnel, drifts, and winze to glory-hole; erection of a 3-rail gravity tramway 2200 ft. long between the mine and the mill (difference in elevation 700 ft.), with ore-bins at both ends; erection of a concentrating mill with a capacity of 300 tons per day; and the laying of a 2000-ft. pipe-line from a lake to the mill for water-supply. The mill includes one 20 by 10-in. Allis-Chalmers improved Blake crusher; one 24 in. by 5-ft. Allis-Chalmers improved apron-feeder; two 5 by 4-ft. Allis-Chalmers ball-granulators, fitted with patented open-end combination-feeders; 3 Colorado Iron Works impact-screens; a series of five Overstrom universal concentrating tables; hydraulic classifiers; elevators, etc. In 75 days the whole plant was erected, in spite of unusual difficulties. Alvin B. Carpenter was in charge of all operations.

Copper City.—The Baxter mine, one of the Bully Hill group, is shipping ore to the Kennett smelter. The mine is under lease to J. W. Schoonover, Lem Williams, and Dan Harrigan.

Oroville.—The Natomas company has shut-down its No. 2 dredge on the Feather river. After working for nearly 11 years the hull is in bad condition. Two other boats will finish the ground remaining. G. W. Akers was dredge-master. Only two dredges are now working in the district.

Trinity Center.—The hull of the new wooden dredge of the Estabrook Gold Dredging Co. was launched here on November 28. The hull is 152 ft. long, 68 ft. wide, and 23 ft. deep. This boat will take the place of an old one that was worn out and sank early in the year. It is expected that the new boat will be ready for operation by April 1, provided all the machinery can be hauled in from Redding before snow falls.

Winthrop.—The Bully Hill new flotation plant is working satisfactorily.

COLORADO

Central City.—The Pilgrim Gold, Silver, Copper M. & M. Co. has bought the Two Forty mines in the Russell district. Boston capital is largely behind the business. The Argo tunnel lies close to the claims at a depth of 1500 to 1700 ft. The property has been opened by tunnels and shafts. A motor-driven compressor is to be erected. The mill, built on the hill-side, contains 10 stamps and a flotation plant.

Ouray.—Camp Bird Limited announced in London on November 26 the following: "Stretch 20 ft. long; width 12 in.; sample 2 to 3 oz. gold and 10 to 20 oz. silver." This ore was found in exploring from the long adit. Shares in London jumped from 3s.6d. (84 cents) to 17s. ($4.08) in one day.

IDAHO

Hailey.—Developments at the Independence mine of the Federal M. & S. Co. are reported to be very encouraging. One ore-shoot is over 200 ft. long and 600 ft. deep on the dip of the vein. The daily output of high-grade ore and concentrate is 25 tons.

Mullan.—At the National copper mine a winze is down 65 ft. below the 1500-ft. level. It has been following a shoot of 1½% ore. A good body has been opened on the 800-ft. level, while there is a large quantity of ore broken above the 800, 1200, 1400, and 1500-ft. levels. The flotation mill is working one shift but the manager, Charles McKinnis, expects it to be running full time at half capacity by the new year.

MISSOURI

Joplin.—Assayers in the zinc-lead districts have agreed to charge to the purchasing company all umpire or third samples. There has been a good deal of dissatisfaction over this question, the assayers frequently receiving nothing from either buyer or seller for the umpire assays, which cost from 75c. to $1 each.

Production of the Tri-State region last week was as under:

	Blende, tons	Calamine, tons	Lead, tons	Value
Kansas	31	...	242	$20,842
Missouri	749	341	118	60,371
Oklahoma	3,471	...	837	237,295

Average prices were $48, $38, and $80 per ton, respectively. Smelters purchased 10,000 tons at $45 per ton, about double the weekly quantity under the agreed price.

MONTANA

Butte.—Fire broke out on the 900-ft. level of the Colusa-Parrott mine of the Anaconda company on December 11, but the management expected to have it under control the next day. Men from adjoining mines were withdrawn early.

East Butte pays $1.50 per share on December 21. East Butte produced 2,050,000 lb. of copper in November, up to the average, and equal to that of the same month in 1917.

The November output of Butte & Superior was 9,500,000 lb. of zinc and 185,000 oz. of silver. The recovery was 94%. In September the yield was practically similar, but all other months have been above 11,000,000 lb., save in May, when it was 6,850,000 pounds.

Anaconda produced 22,600,000 lb. of copper during November. Save the 21,800,000 lb. in September, the outputs have steadily decreased from the 28,400,000 lb. in May. Influenza and the other factors have hindered operations.

Clancy.—The Legal Tender Mining Co. has a new shoot on the 200-ft. level. It carries high-grade silver ore next to a dike and is distinct from any other shoot worked in the past. Six men are taking out ore, the best of which assays 1000 oz. per ton.

East Helena.—The Economy Gold Mining Co. expects to have its 125-ton concentrating plant in operation early in 1919 at the mine in Mitchell gulch, south of this place.

Great Falls.—The Anaconda company's ferro-manganese plant, newly erected by October 15, was shut-down indefinitely on the sixth.

NEVADA

Ely.—Nevada Consolidated pays 75c. per share on December 31. This makes $3.25 for 1918, compared with $4.15 last year. During November the copper output was 6,601,000 lb., nearly up to the average.

Pioneer.—The Consolidated Mayflower mine has been taken over by J. H. Miller of the Western Ore Purchasing Co., and associates. J. B. Kendall recently examined the property, his samples averaging high. The main shaft is 530 ft. deep. The mill has treated 11,000 tons of gold ore, yielding $158,000 net.

Reno.—The fifth session of the Prospectors' Short Course, held annually at the Mackay School of Mines, University of Nevada, will open on January 6 and continue until February 1. The course offers an admirable opportunity for the mining man to brush-up his knowledge along the lines of prospecting, assaying, mineralogy, geology, etc. No charges are made for instruction in this course, although there is a $5 fee charged to cover the cost of supplies used. Text-books are not required, but certain texts are recommended, as it is usually difficult for members of the class to keep satisfactory notes. A certificate is issued on the satisfactory completion of the course.

Tonopah.—On January 1, Tonopah Extension pays a dividend of 5%, equal to $64,140.

Virginia City.—The Mexican Gold & Silver Mining Co. has levied an assessment (No. 110) of 10 cents per share.

NEW MEXICO

Nogal.—The Vera Cruz Leasing Co. has ordered $15,000 of machinery to increase its mill and cyanide plant capacity to 100 tons daily. A tunnel 675 ft. long has developed 60,000 tons of $8 gold ore. Costs are estimated at $4 per ton. Electric power is used. R. R. Foster of El Paso, Texas, is general manager.

Santa Rita.—Chino Copper pays $1 per share on December 31. This makes $4.50 for the year, against $9.90 in 1917. The November metal output was 6,464,285 lb., well up to the monthly average.

OKLAHOMA

Picher.—Production of Oklahoma fields last week totaled 3471 tons of blende and 837 tons of lead, valued at $237,295.

UTAH

Bingham.—On December 31, Bingham Mines pays a dividend of 50c. per share, making $2.50 for the year.

The Utah Apex Mining Co.'s report for the past year shows that ore sales, etc., realized $1,707,635. The net profit was $255,858. Litigation cost $68,138. The metal output was 6171 oz. gold, 644,551 oz. silver, and 42,811,805 lb. of lead.

The Utah Consolidated filed two suits last week against the Utah Apex to quiet title to the Yampa and two Mercer claims.

Utah Copper pays $2.50 per share on December 31. The total for 1918 is $10, against $14.50 in 1917. In November the mills produced 16,500,000 lb. of copper, the lowest since July.

Park City.—This district produced 9134 tons of ore and concentrate during November. The principal yields were: Ontario Silver, 2450 tons; Judge, 2220 tons; Silver King Coalition, 1775 tons; Daly West, 1440 tons; and Daly Mining, 672 tons.

Ontario Silver company pays 50c. per share, amounting to $75,000, on January 4.

Provo.—Grand Central pays 3c. per share on December 21. This amounts to $18,000, and makes $1,802,000 to date.

Silver City.—The Tintic Milling Co., treating ores from the Iron Blossom and Dragon Consolidated, recently shipped 63,368 lb. of bullion, containing $59,000 of silver, $11,000 of copper, and $300 of gold.

Tintic.—The district output in November was 649 carloads of ore and concentrate. There were 28 companies and lessees contributing to the output.

Tintic Standard, which shipped 76 carloads last month, paid 10c. per share on December 20. This is equal to $117,470, making $398,873 to date. A large body of ore has been blocked out at the 1300-ft. level.

CANADA

British Columbia

Grand Forks.—The Granby Consolidated company's smelter here, closed for a period because of lack of ore and coke, the result of the influenza epidemic, has resumed operations. Three furnaces now are in blast, and it is expected that there will be no further interruption, supplies being assured.

Ontario

Cobalt.—Nipissing pays a dividend of 10%, equal to $600,000, on January 20.

McKinley-Darragh-Savage company will pay a dividend of 3%, equal to $67,428, on January 1. The total to date is $5,402,023.

The Mining Corporation paid 18¾c. per share, equal to $311,259, on December 14. This makes a total of $5,906,097.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

J. E. Clennell is going to Chihuahua, Mexico.

Lewis P. Shakleford, of Juneau, Alaska, is visiting San Francisco.

George O. Bradley has returned to San Francisco from British Columbia.

Huntington Adams passed through San Francisco on his way to Antofagasta, Chile.

Peter P. Antipin, metallurgical engineer, of Kyshtim, Russia, is in San Francisco.

Horace V. Winchell passed through San Francisco on his return from Oatman, Arizona, to Minneapolis.

Leon Benett, captain in the French army, is visiting San Francisco in connection with mining business.

D. C. Jackling has returned to San Francisco from a tour of inspection to the copper mines under his direction.

Oscar F. Graff, formerly mining engineer at Kennecott, Alaska, now in the service of the Sulitelma Co., is living at Tolgen, Norway.

E. C. Voorheis attended the meeting of the Bureau of Mines at Washington on December 16 as a representative of the tungsten producers.

Edgar Rickard, by Executive Order of the President dated November 16, has been appointed to act as Food Administrator in the absence of Mr. Hoover in Europe.

W. L. Honnold is now in Paris on a special mission from the Guaranty Trust Co. of New York, but this does not affect his connection with the Anglo-American Corporation of South Africa.

Obituary

Howard W. Du Bois died on November 10 at Philadelphia, where he was born in 1868. He graduated from Lehigh University in 1892, and became partner with Charles T. Miner three years later. From 1896 to 1904 he was Professor of Applied Mathematics in the Central High School, at Philadelphia, but he spent his vacations in mining work, chiefly in Alaska and British Columbia. His illustrated lectures will be remembered with pleasure by many.

E. H. Wilson died at Warm Springs, Montana, on November 27, at the age of 67. A native of Louisiana, he graduated at Washington University, St. Louis, in 1870 and engaged at once in civil engineering, chiefly for railroad companies. In 1884 he joined John Gillie in engineering practice and they continued their partnership for 14 years. In 1898 he was retained by Heinze, and when that operator became inactive he returned to private practice. In 1891 he was president of the Montana Society of Mining Engineers. In 1899 he was a member of the State legislature.

Thomas G. Brown of Denver, Colorado, died at Lluvia de Oro, in Chihuahua, Mexico, on November 19 of pneumonia following influenza. He was 31 years of age and graduated from the Golden School of Mines in 1907. After graduation he spent some time in Colorado, being employed at the Tomboy and other mines. In 1910 he joined the staff of the Mines Company of America and was employed at both the Dolores mine, in Chihuahua, and the Creston-Colorada, in Sonora, for a number of years. In April 1917 he became assayer and chemist for the Lluvia de Oro Gold Mining Co., and in that capacity he was serving at the time of his death. His professional ability was of a high order and his personal qualities endeared him to a host of friends.—A. J. V.

THE METAL MARKET

METAL PRICES

San Francisco, December 17

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	10.00
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	7.30—7.80
Platinum, Government price, per ounce	$105
Quicksilver, per flask of 75 lb	$110
Spelter, cents per pound	10.50
Zinc-dust, cents per pound	16.00

Antimony in stock at June 30, 1918, amounted to 2899 tons, against 3577 tons at the end of May and 4686 tons at the end of April. Imports of metal—January to August—were 7294 tons; in the whole of 1917 the total was 17,825 tons. Imports of ore in these periods were 2404 and 10,370 tons. Smelter production from domestic ores was 123 tons and from foreign ores 1707 tons, in the 8 months of 1918.

ORE PRICES

December 17

Chrome, no definite quotations available.	
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$0.75—$1.00
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$17—$23

EASTERN METAL MARKET

(By wire from New York)

December 17.—Copper is stagnant, 26 cents being the asking price. Lead is inactive and easy. Spelter is dull and easy.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15. On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date		Average week ending	
Dec.	11	Nov. 4	26.00
"	12	" 12	26.00
"	13	" 19	26.00
"	14	" 26	26.00
"	15 Sunday	Dec. 3	26.00
"	16	" 10	26.00
"	17	" 17	26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.09	23.50	Nov.	31.95	23.50	26.00
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government fixed its maximum at 49½ pence, on September 2, but on November 12 this was changed to 48¾ pence, due to a drop in price.

Date		New York, cents	London, pence	Average week ending		
Dec.	11	101.12	48.75	Nov.	4	101.12
"	12	101.12	48.75	"	12	101.12
"	13	101.12	48.75	"	19	101.12
"	14	101.12	48.75	"	26	101.12
"	15 Sunday			Dec.	3	101.12
"	16	101.12	48.75	"	10	101.12
"	17	101.12	48.75	"	17	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.62
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68 51	100 73	101 12
Apr.	61.37	72.51	95.35	Oct.	67.86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	101.12
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

The condition of the silver market in London is unaltered. Trade demand is hardly so active as it has been of late. Shanghai exchange is quoted 5s.1d. ($1.22) per tael. News concerning Indian crops is rather better, as the north-eastern monsoon is progressing favorably. Indian currency returns are as under in lacs of rupees (1 lac = $32,000):

	October 31	November 7	November 15
Notes in circulation	13,643	13,761	13,867
Reserve in silver coin and bullion	2,991	3,109	3,211
(within and without India)			
Gold coin and bullion in India	2,040	2,040	2,044
Gold coin and bullion out of India	12	12	12

The above figures show that the silver holdings, within and without India combined, continues to increase; this fact, however, is owing really to heavy purchases in America. For instance, of 2793 lacs, the total holding on October 7, 2207 were within India, while on November 15, of 3211 lacs only 1765 were so held. The stock in Shanghai on November consisted of 20,600,000 oz. in sycee and 11,200,000 dollars (50c. each), compared with about 22,550,000 oz. and 11,200,000 dollars on November 9.

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York. This was reduced to 7.05c. on December 2.

Date			Average week ending		
Dec.	11	7.05	Nov.	4	8.05
"	12	7.05	"	12	8.05
"	13	7.05	"	19	8.05
"	14	7.05	"	26	8.05
"	15 Sunday		Dec.	3	7.85
"	16	7.05	"	10	7.05
"	17	7.05	"	17	7.05

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6 86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	8.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	8.05
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

Lead concentrate—80% metal—is now selling for $80 per ton at Joplin, Missouri. This is a drop of $20, due to the lower price of the metal.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date			Average week ending		
Dec.	11	8.60	Nov.	4	8.96
"	12	8 60	"	12	8 91
"	13	8.60	"	19	8 62
"	14	8.55	"	26	8 61
"	15 Sunday		Dec.	3	8 67
"	16	8.55	"	10	8.61
"	17	8.55	"	17	8.58

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8 87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16 01	9.41	7.29	Nov.	11.81	7.76	8.75
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

The zinc-ore market at Joplin, Missouri, was fairly strong last week. Second-grade concentrate, 60% zinc, averaged $48 per ton.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government was taking 40% of the United States quicksilver output, paying therefore $105 per flask, and will continue to pay this until contracts are completed. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date					
Nov.	19	120.00	Dec.	3	120.00
"	26	120.00	"	10	120.00
			"	17	110.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	205.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110.00	Nov.	79.50	102.50	120.00
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the new international agreement, the United States is to get 66% of the world's supply of tin. On December 3 the War Industries Board fixed the price to consumers and jobbers at 72½c. f.o.b. Chicago and Eastern points, and 71¼c. on the Pacific Coast.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85.00	Aug.	38.88	62.53	91.33
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	78 82
May	49.10	63.21	100.01	Nov.	44.12	74.18	73.67
June	42.07	61.93	91 00	Dec.	42.55	85.00	....

Eastern Metal Market

New York, December 11.

The markets that have been under war control continue so regulated, with no definite information as to any change in policy.

Copper is under control until January 1 at least, with conditions unchanged.

The tin market is not active, but is steadier as a result of the clearing-up of the control situation.

The lead market is lifeless, with re-sale metal reported as offered under the agreed price.

The zinc market has turned quiet, but is steady.

Antimony is inactive and unchanged.

At a meeting of steel manufacturers in New York, December 9, the general committee reported quite unexpectedly in favor of a 'moderate' reduction in prices in pig-iron and all rolling-mill products effective January 1. This was endorsed by a practically unanimous vote, putting the matter in the committee's hands with power. This committee is in conference with the War Industries Board today at Washington, and an announcement is looked for revealing lower prices throughout the list except iron ore. It is reported that pig-iron will be reduced $3, plates and shapes $5, and sheets and tin-plate $10 per ton. While the Board has indicated that there will be no Government prices on iron and steel after December 31, it may announce the new schedule as prices which manufacturers will seek to maintain as a fair readjustment from the war level.

COPPER

The copper market, as a market, is dead. There is no demand and no initiative. Consumers are merely waiting developments. Producers are not selling any metal except for delivery in December, and then only at 26c. with very little moving. Nothing will be done and nothing known about the market's future until some decision is made regarding conditions that are to rule after January 1. It is expected that a conference this week or the next will settle the matter. Whether a controlled or an open market will prevail depends on the attitude of the War Industries Board. Many expect either an open market or a lower controlled price. It can be stated authoritatively that the Government is taking all the metal it contracted for. No confirmation of any sales of electrolytic or Lake copper under the fixed price of 26c. is obtainable, nor is such likely the case. Casting copper continues to sell around 23c. per lb. A sale of 10,000,000 lb. to the Italian government at 26c. is not confirmed. We quote the market at 26c., the fixed price, which is effective until January 1. John D. Ryan has been elected as the chairman of the board of directors of the Anaconda Copper Mining Co. and president of the United Metals Selling Company.

TIN

The announcement last week of a decision as to the handling of the importations of tin, the price at which it is to be allotted to consumers has relieved the situation, and also somewhat steadied what little market there was, that in re-sale metal. This had sold down in small lots to 70c., New York, but is now quotable at 72c., New York, at which level a few sales have been made. Some re-sale lots have been withdrawn and there is a little better demand. The general situation, however, is very mixed and some interesting, perhaps sensational, developments are possible. It is an interesting fact that the United States Steel Products Co. now has allocated to it 10,000 to 12,000 tons of tin, only part of which has arrived, and also that a conservative estimate places the stock in consumers' hands who have over-bought at 20,000 tons, or both together equal to a six months' supply. As announced last week the fixed price of tin allocated to and imported by the U. S. Steel Products Co. is 72.50c. per lb., New York and Chicago, and 71.25c., Pacific ports, with the 'outside' market now 72c., the latter referring to such Banca and Straits tin as is available for re-sale. An interesting report is that the Tin Importers' Association is "to make a strong protest against the import without restriction of Bolivian concentrate for smelting into tin here, and the delay thereby caused in the liquidation of the supplies of the U. S. Steel Products Co. At present prices it is estimated a profit will accrue to the American smelters of about 14 to 15c. per lb., and that their output will be around 1500 tons per month, or one-third of the probable entire United States consumption in the next few months." The London market is £270 per ton for futures. Arrivals so far in December have been 450 tons at Pacific ports and 30 tons at Atlantic.

LEAD

The recent reduction in the agreed maximum price on lead has not stimulated buying, and the market is lifeless. Quotations continue at 6.75c., St. Louis, or 7.05c., New York, with no sales reported. Rumors are to the effect that re-sale metal has appeared and even sold at 6.75c., New York, but this has not be verified. The War Trade Board has removed pig-lead from the export conservation list. The general situation is still in the control of the Lead Producers' Committee; how long it will remain so is problematical.

ZINC

The market has quieted down considerably after a week or 10 days of fairly liberal buying of prime Western by galvanizers and for export. Much of this has been for delivery in the first quarter. For early or December delivery the quotation is 8.25c., St. Louis, or 8.60c., New York, for prime Western, with prompt metal scarce. For the first quarter the quotation is 8c., St. Louis, or 8.35c., New York. The Government weekly report of stocks and output for the week ended November 30 shows little change, the increase in each case not being large.

ANTIMONY

The market is dull and unchanged at 8.50 to 8.75c., New York, duty paid for wholesale lots for prompt and early delivery.

ALUMINUM

Government prices still control the market for No. 1 virgin metal and for scrap metal at 33c. per lb. for 50-ton lots, 33.10c. per lb. for 15 to 50-ton lots, and at 33.20c. per lb. for 1 to 15-ton lots. The metal is now practically free for domestic consumption.

ORES

Manganese Alloys: The market for both ferro and spiegel is dead. The former is obtainable at $240, delivered, as re-sale alloy, while most any analysis of spiegel can be bought at $70, furnace.

Molybdenum: The market is nominal at 75c. to $1 per lb. of 90% concentrate.

Tungsten: The market is at a standstill, and there has been no effort to test it. Your correspondent was told on the 10th that there is about 3000 tons of concentrate in and around New York bought at recent high levels, with holders very nervous as to the future. The committee of tungsten men has laid the situation before the U. S. Bureau of Mines and the War Trade Board, and it is stated considerable 'sympathy' was expressed for them.

Book Reviews

The Mineral Industry for 1917. Volume XXVI. Edited by G. A. Roush and Allison Butts. Pp. 928, ill., index. McGraw-Hill Book Co., New York, 1918. For sale by 'Mining and Scientific Press'. Price, $10.

Many difficulties prevented this annual reference from publication before the last month of the year following that to which the work refers, yet it is unfortunate that it cannot be issued by August at the latest. Probably now that the War is over an effort for early publication will be made. Apart from this condition, 'The Mineral Industry' is as valuable as heretofore, and should be on the shelves of those who have to keep in touch with the statistics, technology, and trade of the world's metals and minerals. The United States, on account of trouble in foreign countries, is given most of the space, which, by the way, is only 11 pages less than in the previous volume. The 42 contributors are all well known specialists; a few changes are noticeable in the list for this issue. As usual, copper, iron, lead, and zinc are given considerable attention; but miners and metallurgists in the West will find plenty of interest in the chapters on antimony, borax, chromium, fluorspar, gold and silver, graphite, megnesite, manganese, molybdenum, potassium and sodium salts, pyrite, and tungsten. Progress in ore dressing occupies 63 pages, bringing out the points of discussion and new machines for the year. Eighty pages of statistics—necessarily not complete for foreign countries—completes a valuable compendium.

The Occurrence, Chemistry, Metallurgy, and Uses of Tungsten. With special reference to the Black Hills of South Dakota. By J. J. Runner and M. L. Hartmann. Bulletin No. 12 of South Dakota School of Mines, Rapid City, 1918. Pp. 264, ill., index. Obtainable by writing to the above address.

With this valuable treatise, that of F. L. Hess of the U. S. Geological Survey, and that of Herman Fleck of the Colorado Scientific Society, the tungsten producer, maker of ferro-tungsten, chemist, student, and prospector, should be fully equipped for a study of this important mineral. The South Dakota School of Mines has been particularly active in tungsten investigations, naturally enough, as the Black Hills has some good deposits of wolframite. This "paper" (so called in the preface) covers the whole subject in detail. In the chapter on the geologic occurrence of tungsten we find the types discussed under segregation deposits, pegmatites, veins, replacement deposits, contact metamorphic deposits, and placers. Enough data has not been secured in any country to determine the persistence of tungsten at depth. The Black Hills deposits are fully discussed, with figures of production and notes on dressing the ore. The chemistry, metallurgy, and uses of tungsten are thoroughly described, including the manufacture of ferro-tungsten. Laboratory tests include qualitative, quantitative, and specific gravity methods. The bibliography of 95 pages, by Mr. Hartmann, must have entailed great research, and in it one can find everything written on tungsten.

The Adirondack Graphite Deposits. By Harold L. Alling. Pp. 150, ill., maps, index. Bulletin 199 of New York State Museum, University of the State of New York, Albany, 1918. Obtainable by writing to the above address.

Judging by the enquiries received by the 'Press', an increasing number of people are becoming interested in graphite. New deposits are being developed in this country, and new literature on the subject is needed. In this treatise will be found not a dry dissertation on the specified deposits of the Adirondack country, but the work of producing companies, concentration of ore, and problems therein, prices, and other interesting points. Those interested in graphite will gain by securing a copy of this bulletin.

Modern Shipbuilding Terms. By F. Forrest Peace. Pp. 143, ill. J. B. Lippincott Co., Philadelphia. For sale by 'Mining and Scientific Press'. Price, $2.

This is one of the best among the books that have been published recently to meet the need for information regarding shipbuilding. The author is an instructor in the training section of the Emergency Fleet Corporation. About 2000 terms are defined in non-technical language. The appendices contain discussion of electric, oxy-acetylene, and oxy-hydrogen welding with illustrations showing the various types of welds, a description of the Isherwood system, and a bibliography. There are about 70 plates illustrating many of the terms defined.

Hydraulic Experiments with Valves, Orifices, Hose, Nozzles, and Orifice Buckets. By A. N. Talbot, F. B. Seely, V. R. Fleming, and M. L. Enger. Pp. 76, illustrated. Bulletin No. 105 of University of Illinois Experiment Station, Urbana, Illinois. Obtainable by sending 35 cents to the above address.

Hydraulic and hydro-electric engineers and others will find in this a useful lot of tests and conclusions. The free flow and efficient use of water is of great importance.

Company Reports

SANTA GERTRUDIS COMPANY, LIMITED

Property: mines and mills in Pachuca district, Hidalgo, Mexico.

Operating Officials: Hugh Rose, general manager; C. A. Lantz, general supervision; T. C. Baker, mine superintendent; W. E. Crawford, mill superintendent; F. H. Walsh, mechanical and electrical engineer; D. F. Moss, accountant; W. J. Cox, advisory engineer.

Financial Statement: the profit for the year ended June 30, 1918, was £112,544 ($537,000), plus £21,329 ($101,000) brought forward, a total of $638,000. After paying dividends there was a balance of £1498 ($7200).

Dividends: two, totaling £131,250 ($628,000) were paid.

Development: labor was plentiful and mining supplies were readily obtainable. Work was considerably hampered during the second and third quarters of the year owing to loss of a shipment of dynamite; also to the diversion of compressed air to the operation of pumps in the recovery of the flooded 20th level. Exploration covered 7014 ft. Of this, 2608 ft. was in payable ore, 2590 ft. in vein below pay, and 1816 ft. in rock. There was pumped from the mine an average of 748 g.p.m. The rate of ore extraction was 80.7% of normal capacity. Reserves are estimated at 880,433 tons, containing 53,987 oz. of gold and 9,595,000 oz. of silver, this being the recoverable metal.

A 20 years' working agreement was arranged with El Bordo, Malinche, El Cristo, and La Zorra properties of 431 acres in the Pachuca district. The first named is estimated to contain 253,000 tons of ore, which should yield a profit of $2,142,000. The mine is on the Viscaina vein, one of the largest in this district. In about 12 months El Bordo should produce 500 tons of ore daily. The Malinche has splendid possibilities.

Production: the new mill worked at 80.7% capacity, partly due to shortage of cyanide and partly on account of trouble in settling and filtering. There was treated 324,-

762 dry tons of $14.06 ore, of which 87.95% was extracted. The ore contained 21,856 oz. of gold and 3,775,745 oz. of silver .

Flotation tests showed that the process in its present stage is unable to compete commercially with cyanidation. The plant will be enlarged by a ball-mill, tanks from the idle Guadalupe mill, and another filter-press. Aluminum dust is used in place of zinc dust as a precipitant.

CAMP BIRD, LIMITED

Property: gold mine and mill in Ouray district, Colorado.

Operating Officials: W. J. Cox, general manager; T. H. Woods, mine superintendent.

Financial Statement: the company derived no revenue from mining operations, but received £67,394 ($321,000) from the Santa Gertrudis company in Mexico. The profit for the year ended June 30, 1918, totaled £74,745 ($374,000). After paying two preference dividends, amounting to £45,474 ($216,000), the balance for the current year is £29,272 ($158,000). Assets, including £1,032,801 in Santa Gertrudis shares at par value, total £1,080,466 ($4,380,000). Cash amounts to £112,052 ($537,000).

Development: the Camp Bird vein was encountered in the tunnel on June 1, 11,000 ft. from the portal (compared with the estimated distance of 10,700 ft.), and vertically under the third-level adit, approximately 1450 ft. The vein in appearance is characteristic of exposures of barren vein in the upper levels, which includes strike, dip, and many features peculiar to this vein. A 77-ft. drift to the west was made, disclosing an increasing width of vein until at the face it is 8 ft. between walls, half of which is quartz, carrying sulphide, including spots of galena. To the east from the tunnel intersection the vein is not so plainly defined, and a turn to the north combines to make it more difficult to follow. Including an absence of gold-silver content, vein structure at this horizon compares favorably with this section in the third level. The tunnel now becomes the east-west dividing line of workings on the vein. That to the east is designated 'tunnel level east', and that to the west 'tunnel level west'. It is of first importance to obtain natural ventilation for this two-mile tunnel. This will be obtained by driving east on the Camp Bird vein to a projection of No. 3 shaft, and then by raise connecting with the ninth level, estimated to be accomplished in January 1919. Meanwhile the level west will not be advanced.

TOMBOY GOLD MINES CO., LIMITED

Property: mines and mill in the Telluride district, Colorado.

Operating Officials: D. A. Herron, general manager; J. S. Peterson, assistant; W. K. Betty, consulting metallurgist; P. L. Foster and R. M. Raymond, consulting engineers.

Financial Statement: the revenue for the year ended June 30, 1918, was £239,449 ($1,150,000). Expenses totaled £182,084 ($864,000), leaving a profit of $286,000. After paying dividends there was carried forward £35,168 ($168,000), compared with £30,726 ($144,000) brought forward from 1916-'17. Current assets total £85,016 ($408,000), and liabilities £30,106 ($144,000).

Dividends: two, amounting to £23,250 ($110,000) were distributed.

Development: in the Argentine mine, 568 ft. of work was done on the east faces of the 1900 and 2100-ft. levels. In 359 ft. of the upper level, 5 ft. of ore averaged $3.62 in gold and silver, 4.45% lead, 6.89% zinc, and 0.8% copper. At 2100 ft. depth, 111 ft. driven on 4.2 ft. of ore assayed $2.83 in precious metals, 2.13% lead, 4.42% zinc, and 0.95% copper. Reserves are 130,000 tons, of which 100,000 tons are broken in stopes.

In the Montana mine, exploration covered only 3346 ft., much lower than usual due to the labor supply. About 1500 ft. of this was done on the Virginius vein, 400 ft. being through the Robson claim of the Camp Bird company. Within the Tomboy boundaries, this body is 900 ft. long, assaying $9 in gold and silver, across 3 ft. Other workings show $15 across 6 ft., and $12 silver and 5.9% lead over 4 ft. Reserves are estimated at 350,000 tons, exclusive of the Sidney and Virginius. Of this, 200,000 tons are broken.

Production: the mill concentrated 151,028 tons of ore, and the cyanide plant 129,089 tons of tailing, yielding amalgam worth $306,003, concentrate worth $661,683, and cyanide bullion worth $166,569. With sundries, the total revenue was $1,131,267. Costs were $5.58 per ton.

Experiments made on Tomboy ores by flotation give hope of solving the problem of their treatment in the near future.

McINTYRE PORCUPINE MINES, LIMITED

Property: gold mines and mill near Porcupine, Ontario.

Operating Official: R. J. Ennis, general manager.

Financial Statement: the revenue during the year ended June 30, 1918, totaled $1,714,258. Operations, administration, and sundry adjustments, left a profit of $811,572. After deducting $131,211 for depreciation, the net profit was $680,361. With the surplus from 1916-'17 there was available $1,413,715. Current assets amount to $393,679, and liabilities $106,181. Investments at cost are $104,117, and depreciation and general reserves $532,207.

Dividends: three of 5% each, amounting to $541,542, were paid.

Development: there was 6893 ft. of work done, also 6987 ft. of diamond-drilling, making 51,544 and 26,907 ft., respectively, to date. The shortage of men—a falling-off from 380 to 295—made it impossible to do the exploration planned. Ore-reserves to a depth of 1000 ft. are estimated as 459,276 tons, averaging $9.80 per ton. Electric hoists of 2000 ft. capacity were placed at No. 5 and 1 shafts of the Jupiter. An electric storage-battery was installed during the period.

Production: The mill treated 178,327 tons of $9.30 ore, extracting 95.6%. The total since 1912 is $611,525 tons of $9.28 ore. Costs totaled $5.1466 per ton. A set of 60 by 30-in. rolls was added to the crushing-plant, the main shaft to follow the 7½ gyratory crusher, and reduce the ore suitable for the ball-mills in the cyanide mill.

KERR LAKE MINES, LTD.

Property: silver mine at Cobalt, Ontario.

Operating Official: H. A. Kee, mine manager.

Financial Statement: during the year ended August 31, 1918, sales of ore and metal, plus interest, realized $2,394,219. Operations cost $721,902, leaving a profit of $1,672,317. Assets total $3,076,001, of which $2,040,840 consists of Canadian and American bonds, $325,252 cash, and $549,336 ore in transit.

Dividends: these amounted to $650,000, making $7,710,000 to date.

Development: the total footage was 3089, practically the same as in 1916. No new veins of importance were found, but extensions of the known ore-shoots carried milling ore. Reserves are estimated as 34,730 tons of milling ore containing 639,800 oz., and high-grade ore with 997,500 oz., a total of 1,637,300 oz. Mining cost $5.11 per ton.

Production: 19 veins contributed to the output of 2,038,287 oz. There was 1017 tons of ore sacked for shipment, and the mill treated 27,835 tons assaying 21.09 oz. per ton. In 1916 this averaged 26.26 oz. The sliver content of all products totaled 2,582,993 ounces.

Costs: on a per ounce basis were 9.60c. for underground work, 14.20c. for shipping and treatment, and 0.94c. for general charges, a total of 24.74c. per ounce.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

20-YARD DUMP-CARS IN OPEN-CUT MINING

Steam-shovels and dump-cars are the two most notable results of the development of excavating machinery. The 360-ton revolving-shovels, with their 7 and 8-yd. dippers, were manufactured to meet the demands of stripping coal. Subsequently they were introduced to the Lake Superior iron ranges, with great success.

Development of the side dump-car from the original yard and half-yard sizes to that known as the Western 20-yard automatic compression-lock air dump-car, has been due largely to the increasing demands on the Mesabi iron range, where excavation of ore and overburden reaches the enormous total of 30,000,000 cu. yd. each year. In fact, the U. S. Steel Corporation, which is the largest operator on the range, is partly responsible for the compression-lock car. Fifteen tons of material is lifted every minute and dropped from a height of 7 to 8 ft. into the dump-cars, which become broken under the impact. Nearly three years ago the Corporation's engineers bought ten 20-yd. cars, each of five different makes, and started in to 'break them up' and during many months they were subjected to the hardest kind of stripping service. Out of that rigid test was developed the Western 20-yd. car, manufactured by the Western Wheeled Scraper Co. of Aurora, Illinois. This type was installed on the range in large numbers.

A WESTERN DUMP-CAR

WESTERN DUMP-CAR DISCHARGING

The features that are individual to this car, aside from the well known standard Western mechanical design, are the means of unlocking, locking, and controlling the position of the bed, without the use of side-chains or any fixed connection between bed and underframe. The car is so designed that the shock from the heavy dipper-load—15 tons dropped from a height of 7 ft.—is carried through the truck-springs to the roadbed.

So successful were these cars on the iron range that they have since been installed in the copper districts, where they are used both for stripping and hauling low-grade ore to the concentrating mills. The Copper Queen last year put in a large number of these cars at Bisbee, Arizona, to work at its Sacramento Hill deposit. The United Verde Copper Co. is now using similar cars at Jerome.

The fact that steam-shovel mining can be carried on where conditions are right for half the cost of underground mining makes the question of stripping

STEAM-SHOVEL AND WESTERN DUMP-CARS AT SACRAMENTO HILL MINE OF COPPER QUEEN CO., BISBEE, ARIZ.

one of growing importance, and the development of an air dump-car is an essential factor. In the final analysis, successful steam-shovel operation, whether in ore or stripping, is a transportation problem, pure and simple.

UNDERGROUND MINING WITH ELECTRIC-SHOVELS

Electric-shovels are becoming increasingly desirable in underground mining. For years many of them have been used in iron, coal, zinc, limestone, and salt mines. Their performance has definitely established them as highly economical factors in this class of excavation.

The accompanying chart shows the power consumed by

A THEW ELECTRIC-SHOVEL IN A NEW YORK IRON MINE

one of these shovels in a New York iron mine. The half-tone illustrates a Thew electric-shovel, built by the Thew Automatic Shovel Co., Lorain, Ohio, mining iron ore in New York. It is equipped with a 20-hp. motor, and the record is during the loading of 5 consecutive cars of ore. For car No. 1 it was 16.04 hp.; for No. 2, 20.75 hp.; for No. 3, 16.25 hp.; for No. 4, 17 hp.; and for No. 5, 14.25 hp., or an average of 16.86 hp. for the five.

During the last four months of 1917 and the first five months of 1918, a total of 37,268 tons of ore handled by an electric-shovel was $4824 for labor, $1225 for supplies, and $122 for power, a total of $6171. The average cost per ton was 16.6 cents. These costs cover all the expense involved in actually loading the ore and tramming it 300 ft. to the main haulage-way. They include, also, the expense of moving the shovel to different levels and places. The ore was loaded into 3-ton gable-bottom cars.

Under identical conditions the per-ton loading cost by hand-labor was 30 cents, and by shovel 16.6 cents. The saving effected by the shovel was 13.4 cents per ton, or $5000 in nine months.

A North-Western iron company has used a similar electric-shovel for 4½ years. The ore was 25% fine and 75% lumps, the largest pieces being 24 by 24 by 18 in. This shovel loads from 150 to 220 tons daily. The following table gives the tonnage and the average cost per ton, for each financial year, ended June 30, from 1914 to May 1, 1918:

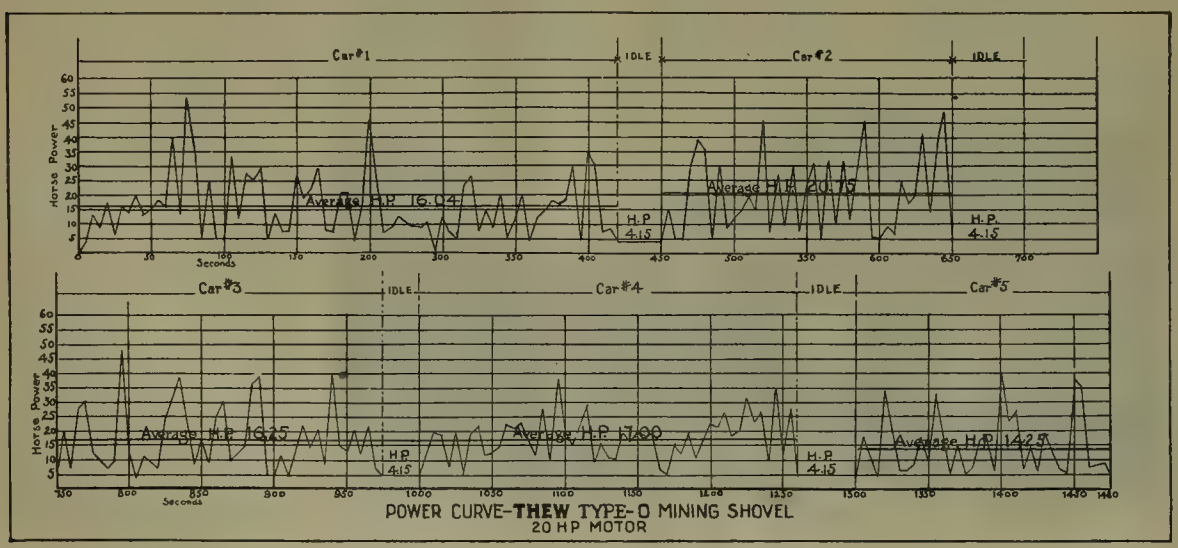
	Electric-shovel		Hand operation		
Year	Tonnage	Cost	Tonnage	Cost	Saving
1914	20,820	$0.268	102,438	$0.466	$0.20
1915	24,497	0.253	34,222	0.324	0.07
1916	32,261	0.304	84,485	0.318	0.01
1917	31,530	0.344	77,653	0.391	0 05
To May 1, 1918..	26,430	0.408	59,646	0.510	0 10

In a Western zinc mine a mining shovel loaded 125 cars in 5¾ hours at a cost of less than 9 cents per ton, including tramming. This represented a reduction in cost of handling material and hauling it to the shaft for hoisting to the surface from 16 and 18 cents per ton by hand to 9 cents by the shovel, a direct saving of 45 to 50%. Five of these shovels are now working in that mine.

The construction of this underground mining shovel is novel, embodying a somewhat radical variation of the standard, full-circle, swing-type steam-shovel.

The motor is of the single, constant-speed type, with friction controls. All electric equipment and connections are simple. Hoisting, crowding, swinging, and propelling movements are all controlled direct from this motor, minimizing physical efforts by the operator and enabling him to easily increase capacity.

In Bulletin PM-42, the **Worthington Pump & Machinery Corporation** describes the 'Superior' crushing-rolls made by the **Power & Mining Machinery Works** of Cudahy, Wisconsin. These machines are manufactured with rolls from 24 to 54 in. diameter, taking a maximum feed of 1 to 2 to 2½ to 4½ in., depending on whether the shells are smooth or corrugated. Some special features have been incorporated in the design of these rolls. A useful discussion on horsepower is included, also notes on the 'simplex' rolls, feeders for rolls, and sectional rolls.



POWER CURVE—**THEW** TYPE-O MINING SHOVEL
20 HP MOTOR

Mining and Scientific Press

Edited by T. A. RICKARD

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Number 26

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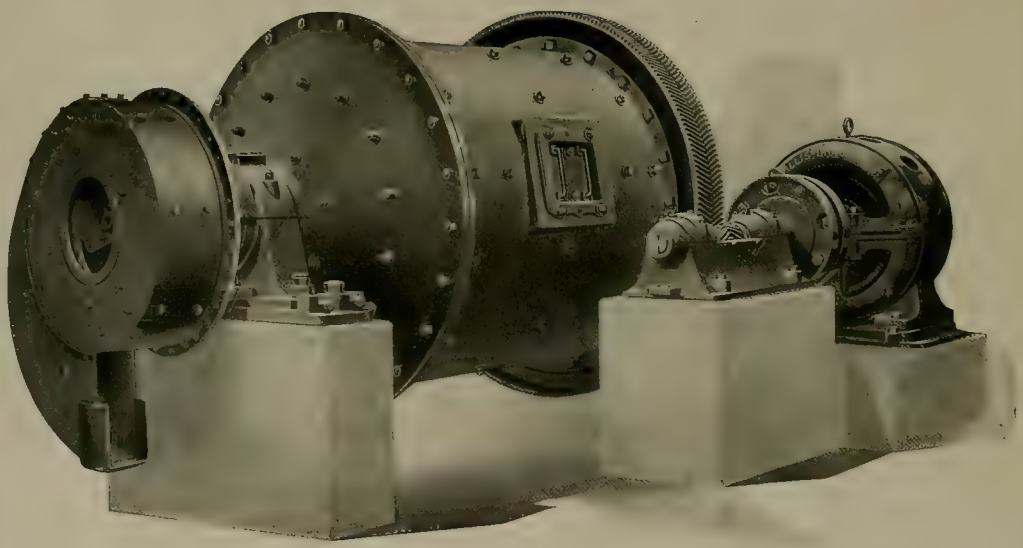
AN INDEPENDENT WEEKLY PAPER OWNED, EDITED, AND MANAGED BY ENGINEERS

ALLIS-CHALMERS BALL GRANULATORS



WRITE FOR BULLETIN No. 1813-J

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MILWAUKEE, WIS., U. S. A.

Entered at the San Francisco post-office as second-class matter.

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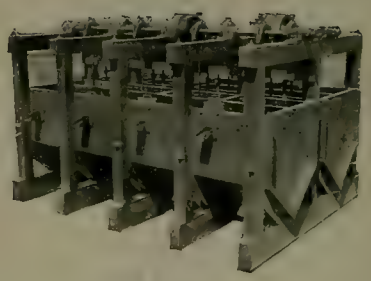
Advertisers' Index, Page 5

Richards Pulsator Jig

THESE figures illustrate the difference in size between two units of equal capacity.

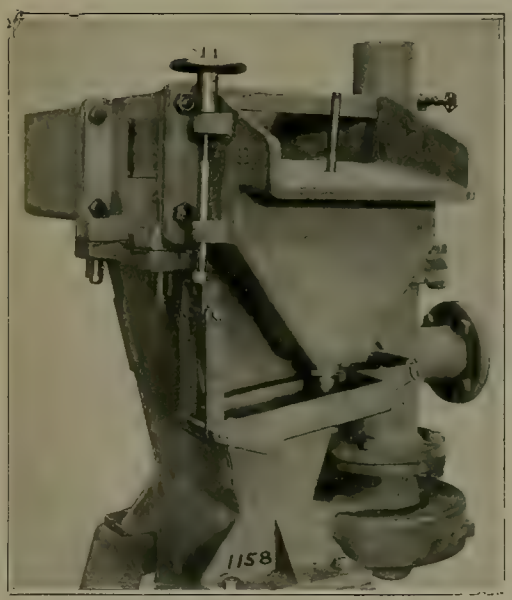


Plunger Type Jig

"TEETERING"

is the name Dr. Richards applies to the action of a Richards Pulsator Jig. A peculiar form of *pulsating* water current, as compared with the rising and falling of the bed in the plunger type of jig makes the difference.

There is no suction stroke—therefore, no clogging—in the



Richards Pulsator Jig

The impulse of the water is always *upwards through* the screen. The particles are repeatedly forced away from—not towards—the screen, thereby keeping it always open, and saving the fine material.

With less power, screen surface, maintenance, and space, this Jig will do everything an ordinary jig can do—faster and better.

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EDITORIAL STAFF

T. A. RICKARD, *Editor*
COURTENAY DE KALB, *Associate Editor*
M. W. von BERNEWITZ, *Assistant Editor*

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C. T. HUTCHINSON, *Manager*
E. H. LESLIE, *600 Fisher Bldg., Chicago*
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Science has no enemy save the ignorant

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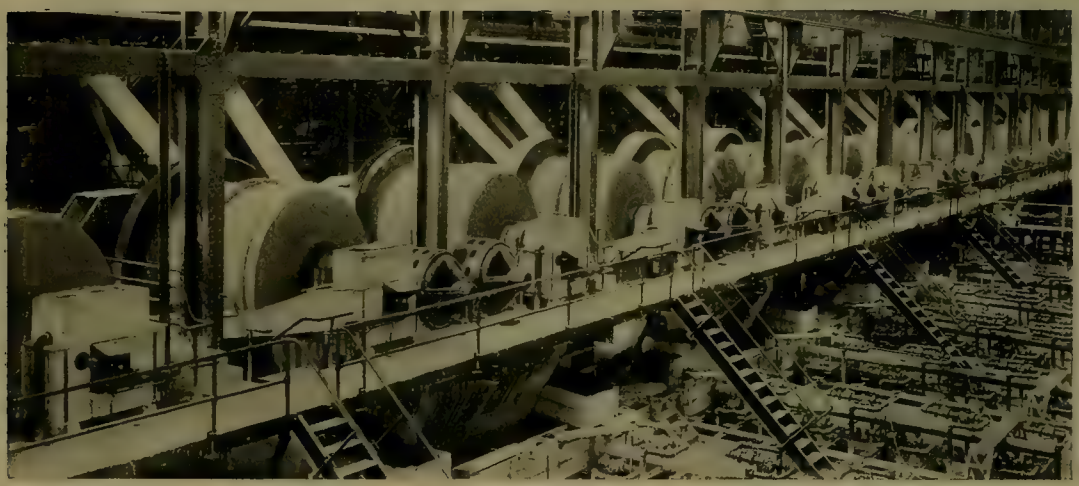
ONE-EASY-STEP



Largest Ball Milling Plant in the World

¶ In most concentrating plants, ore-production is the *big* item of cost.

¶ Here the greatest amount of labor is required and labor today is of course "sky high."

¶ Furthermore, it gets harder and harder to get skilled labor.

¶ With unskilled labor simplicity is essential; which is one reason why Marcy Mills are being generally adopted by successful companies.

¶ The annual reports of various mining companies show that the Inspiration Consolidated Copper is one of the biggest low cost copper producers. "One Easy Step" is the system they use.

THE MINE AND SMELTER SUPPLY COMPANY

A SERVICE STATION WITHIN REACH OF YOU

DENVER SALT LAKE CITY EL PASO

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NO assessment work on mining claims is required on account of 1918.

ESTIMATES made by the U. S. Geological Survey show that the value of the mineral production of this country in 1917, under the spur of war, reached the unprecedented value of $5,010,948,000, exceeding by 43% the previous high record of 1916. Undoubtedly the total for the current year will be even higher. Such figures demonstrate the extraordinary growth of our domestic mining industry.

IN this issue we publish excerpts from a pamphlet on 'The Value of Gold in Our Economic System' written by Mr. Henry Strakosch, the managing director of the Union Corporation, formerly A. Goerz & Co., of London, controlling an important group of mines on the Rand. Mr. Strakosch deals with the subject from the British standpoint, but much that he says is pertinent to the American discussion of the subject.

UNDER the head of 'Discussion' there appears a letter describing conditions in Russia and suggesting that the only practical remedy is the sending of an Allied military force large enough to guard the main lines of transport, so that provisions can be distributed and the people given a chance to resume their normal occupations. Our correspondent has just arrived from Siberia and was recently in Petrograd itself, so that he writes at first-hand. Russia, like the countries of Central Europe, is in need of order, then food, then clothes. The first test of government is the enforcement of order, without which man reverts to his jungle existence and savagery becomes rampant. The Allies, we hope, will co-operate in sending a force of at least 250,000 soldiers to Russia to rescue her from Bolshevist chaos.

RUMORS of good ore having been struck in the old Camp Bird mine, in Colorado, are confirmed by a telegram given out by the company in London, stating that for a stretch of 20 feet and a width of 12 inches samples assay 2 to 3 ounces of gold and 10 to 20 ounces of silver per ton. This ore has been cut in an inclined raise from the new adit to the old workings, so that the exact relation of it to the deeper development of the mine is uncertain. The news stimulated buying of the stock, the quotation for which rose from a little under $1 to $4.25 per share. It takes more than a swallow to make a summer, and more than two swallows to make a drink; likewise twenty feet of two-ounce ore will not make a new mine of the old bonanza at Ouray, but we rejoice at this indication of possibly renewed productivity. The experience of the district and the geologic data are distinctly unfavorable, in our opinion, to the expectation of an ore-bearing horizon in the approach from the andesitic breccia to the sedimentaries, but there may be scope above the lower horizon for the distribution of valuable orebodies. We hope that the expectation of the management will be richly realized.

EVIDENCE is forthcoming to show a revival of interest in mining speculation. Among other signs of the times we note the purring of the wild-cat. We regret that so good a paper as the 'Salt Lake Tribune' should print such a flagrantly irresponsible prospectus as that of the Colorado Pitchblende Company. In this advertisement it is stated that experts testify "without batting an eye" that the mines of this company contain "twenty million tons of ore worth $85 per ton, practically in sight. This means, in round numbers, one billion seven hundred million dollars." The company is said to be capitalized "for only $100,000, divided into 2,000,000 shares." Then comes the remark: "Figure from that, if you dare, what shares in this company will eventually be worth." We dare to make an estimate, and it is very low. Among the experts mentioned by name is "a special writer for the 'Denver Post'," a paper that exemplifies the utter prostitution of journalism; the other professors and doctors mentioned we do not know, but if they endorse the statement of a "reputed specialist" that "the Colorado Pitchblende Company has $900,000,000 worth of profits to realize on", then the more we think of them the less we think of them. Any lingering doubt as to the meretricious character of this enterprise would be removed by other assertions appearing in the prospectus; for example: "The venture is practically without hazard. The ore is right on the surface—actually discernible with the naked eye." It should be noted that the valuable metal that makes it 'ore' is 0.1% of uranium, so that its discernibility to "the naked eye"

presupposes a radio-active vision. One of the directors is a wool-grower; that may explain the effort to pull wool over the eyes of the simpletons to whom only such an invitation would appeal. The 5-cent shares are offered at $2; "every $500 should earn $100,000." In the light of experience, we think this unlikely.

AT the meeting of representatives of mining convened by the American Mining Congress on December 16 and 17, at Washington, a committee was appointed to interview the Secretary of the Interior. He stated that the War Minerals Act was capable of being used [to rectify the wrong done to the producers of chrome], but on account of probable criticism upon the necessary expense he would not avail himself of the Act unless directed to do so by Congress. He favored action to make the Act "applicable for liquidating losses." The convention appointed a permanent executive committee, which includes Mr. Courtenay De Kalb, who went to Washington in the interest of the Chrome Producers' Association. This committee has prepared a congressional resolution, in drafting which the co-operation of Secretary Lane and the Mining Committee of the American Mining Congress was obtained. Immediate consideration is deemed probable. The embargo on imports cannot apply any longer than 30 days more without congressional action.

RECENT official announcements of German and Russian casualties in the War should be taken with a liberal pinch of sodium chloride. The statement from Berlin that only 659,000 German soldiers were killed is a manifest lie, for it would involve the supposition that this number of Germans fell during the fighting in which two million British and French sacrificed their lives, not to mention at least another million of Russians, Italians, Servians, Montenegrins, and Rumanians that fought and fell before the German contingents on the various eastern battlefields. We are asked to believe that fully 4,000,000 of the Allied soldiers had to die in order to kill 659,000 Germans! If that be so, then Germany's debit in the great accounting is just so much the heavier than her bitterest enemy could have supposed. We do not believe the Berlin statistics, recognizing the attempt to soothe the German people into the belief that their losses were relatively small. In days to come the Germans undoubtedly will say that their armies were not defeated but that they had to capitulate on account of lack of food and political disorganization at home. In regard to the Russion estimates of losses in battle, they are stated by the Director of the Russian Information Bureau—a sort of George Creel, we presume—to be 8,000,000 in total casualties, of which 3,000,000 were killed and 1,000,000 disabled for life. We do not believe it. With the published statement of this Information Bureau goes a plea for sympathy because "Russia has sacrificed millions of her sons and all her happiness to make the triumph of the Allied cause possible." That supplies the motive for exaggeration, namely the desire to impress the Allies with the greatness of their debt to Russia. None will refuse to recognize this debt, but it should not be impressed upon us by statistical lies. The two sets of figures, from Berlin and Petrograd, respectively, are vitiated by the evident intention to use them as propaganda.

VARIOUS suggestions are being made as to the amount of money Germany should be made to pay in reparation and restitution. It is well to know what are her financial resources. Before the War the federal revenue of Germany was about 850 million dollars, of which nearly 500 millions was spent on the army and navy. This revenue, however, did not include the revenues of the individual States, and personal taxation was comparatively light. It is estimated that Germany's financial capacity is equal to meeting a fresh debt of about 25 billion dollars involving an annual charge, for interest and sinking fund, of 6%, or 1500 million dollars. Obviously much of the talk of compelling Germany to pay the entire cost of the War to the several belligerents is made without regard to these facts, quite apart from the doubt as to the fairness of imposing a condition apparently not contemplated during the exchange of ideas before the armistice was signed. By the time Germany has been compelled justly to make reparation for the damage, looting, and theft to which the civilian populations of Belgium and northern France were subjected, and has been made to pay for the mercantile marine she sank illegally, she will have a burden big enough to remind at least one generation of Germans that it is unprofitable and unwise to attempt the subjugation of a world in which Frenchmen, Britons, and Americans claim the right to live in their own way.

ON November 1, 1918, the British Metals Corporation was registered with an authorized capital of $25,000,000, of which $10,000,000 has been subscribed privately by "important metal and financial interests." So says the 'Financial Times'. No public issue of shares is to be made. The board of directors is powerful, it includes representatives of the Hudson's Bay Company, the Rio Tinto Copper Company, the Consolidated Gold Fields of South Africa, and Vivian Younger & Bond, the last named being an important firm of metal-dealers. The articles of association provide that the British Treasury shall have the right at all times to be represented on the board by one director, not to be removable except by the Treasury. An official statement explains, among other things, that the principal objects of the company are "to regain and retain for British interests the predominance in the non-ferrous metal trades of the Empire usurped in recent years by German organizations. . . . To support and sustain the general trade of the United Kingdom in non-ferrous metals, and especially to maintain the position hitherto occupied by the market in London. . . . To develop and extend mineral and metal production of the Empire, and to promote the well-being of every interest concerned in the trade." Not much can be done toward carrying out this program

so long as the present restrictions on trading in metals remain in force, but an organization is being created, we are informed, to enable the corporation to assist at once in the rehabilitation of the metal markets. The 'Times', of London, states that the question of reorganizing the metal trade was broached at the Paris Conference in 1916 and that French and Belgian interests made a proposal for inter-Allied action, this proposal being received with such favor that it was decided to establish geographic units, with inter-Allied connections, for the purpose of supporting the metal interests of the Allies as against German monopoly. All this should prove interesting to American producers and sellers of the nonferrous metals because it is bound to have its effect, for instance, on the New York market. Such a combination as the British Metals Corporation may serve patriotic and otherwise useful functions, not only as against German monopolists, but against any system of unfair dealings. There can be no objection to it if it fulfills its avowed purpose "to promote the well-being of every interest concerned in the trade." If it does that it will differentiate itself from the German cartels. In matters of this kind we have an eye always to the possible jumping from the frying-pan into the fire, because a trust or a monopoly in the metal trade either at New York or at London is no better than one established at Frankfort or at Rotterdam. No patriotic veneer suffices to mitigate the ugliness of a cinch.

WE note that the big copper producers propose to co-operate, under the Webb Act, for the purpose of regulating the export of copper. This will serve also as a means for coming together for the purpose of a combination to control the production and domestic sale of their metallic products. The producers of tungsten, we understand, intend to take similar action under the Webb Act, which legalizes combinations for the purpose of regulating the export trade. In this case the camouflage is thin because any foreign trade in tungsten is inward not outward. The largest producer of tungsten in this country, the Atolia Mining Company, has refused to co-operate because it sees no valid reason for the step. Returning to copper, we note that rumor points at the probability of an open market for this metal in January, when the War Industries Board goes out of existence. It is expected that the price will recede and that some of the poorer mines, that is, those operating on a thin margin, may have to suspend work. What the effect of a drop, say, to 20 cents per pound, will be, it is difficult to gauge, because the statements of the producing companies do not afford an entirely reliable criterion of the cost of production. Such data are now given on a basis entirely different from the flamboyant assertions of the pre-War period when the public was being fed on optimistic estimates of 6 and 7-cent costs at the big mines the stock of which was being placed on the market. Then sundry 'overload' items, such as depreciation and depletion, were cheerfully ignored, now emphasis is placed on them; then the credit for the precious metals recovered from the copper ore was deducted from the cost of producing the copper, whereas now it is deducted beforehand in order to circumvent the tax-collector. Such 'book-keeping' makes a difference of from 3 to 5 cents per pound. The future of the industry depends upon the adjustment of the wage-scale; wages were raised in sympathy with the rise in the price of the metal, but, unfortunately, a corresponding decrease, which would be fair, is complicated by the question of living costs, which are likely to go down more slowly than either of the other two basic factors.

Boundaries: Racial and Natural

When the delegates to the Peace Conference begin to fix new frontiers for the disintegrated fragments of the old Europe, as we knew it on the maps printed before the War, they will find themselves approaching their task from different points of view. National boundaries used to follow physiographic lines, such as those of rivers and ranges of mountains; this method of delimitation was in general favor until the 19th century and the political writers of Europe, particularly the French, hardly considered any other idea until 1795. For example, today, should the Rhine be the north-eastern boundary of France and the Vistula the western frontier of Poland? In our own times the contrary idea of ethnic distinctions has become the dominant factor in schemes of territorial readjustment. The lines of demarkation are based upon the indefinite domain of language, on the common assumption that language goes with nationality, and that race is somewhat identical with one or both. For example, President Wilson, in the thirteenth of his Fourteen Points, has suggested that the new Polish State should include "the territories inhabited by indisputably Polish populations." Does that mean the Poland of 1659 or that of 1795? It would exclude Lithuania, although that province formerly was part of Poland; also Dantzig, which is a truly German city; and yet without the port of Dantzig and the province of Lithuania the restoration of Poland would come to a lame conclusion. Eastward the limit of indisputably Polish population is confused by admixture with the Russians and westward the line is lost in a twilight zone of Germanism; villages wholly Polish can be found dispersed among villages truly German; there is an interpenetration of national units so intricate that no line can be drawn by any maker of political maps. The people of Alsace speak German, yet their traditions are French, and they insisted upon being so regarded even when under the German flag. Switzerland has developed national unity, yet it is a tri-lingual country; in the west the people speak French; in the east, German; in the south, Italian. The test of language fails as a synonym for nationality. The Belgians speak more than one language, they had no national traditions until August 1914, when they created one that will endure. They consist of diverse peoples and have nothing in common with the Belgae of school-boy history; that pedigree is as fictitious as any that was ever resurrected

for the gratification of a plutocratic brewer by a subservient College of Heralds. The worst puzzle is that offered by the ramshackle empire formerly under Hapsburg rule. Even the recent disintegration into separate republics does not begin to be based upon racial unity; the diffusion of peoples has been so wide-spread that ethnic islands of alien blood and language are scattered all over the map. In the Balkans the conditions are even more complicated, if possible. Note how Rumania has a large Hungarian island in the middle of it, alongside an archipelago of German color. In truth the attempt to make a new map founded on either race or language is utterly futile. Even 'self-determination', now a popular term in liberal circles, is only, like Mesopotamia, a comfortable word. Self-determination is no more possible for every community or country than for the individual, whose rights have to be compromised for the sake of making a sane world. The multiplication of new republics, each with its own government, laws, and customs duties will bring Europe to the edge of chaos, especially at a time when the life of any one of these units is menaced by all the infantile diseases that menace a newborn State, more particularly those that have sprung like mushrooms from the damp soil of the blood-soaked battlefield. There must be give and take, reasonable compromise, and a willingness to subordinate the non-essential to the essential. The delegates at Versailles will realize that the drawing of boundaries can be fixed on no arbitrary theory of language or race, and that the natural frontier in many cases may prove the least unstable line for readjusting conflicting interests. What the world needs today is good government, not the political chaos of the Bolshevist; it needs the peaceful organization of human life, not the wild disintegration of repellent prejudices; it needs a reasonable spirit of compromise on the part of the individual for the sake of the general welfare, not the fierce assertiveness of the jungle.

The Utah Copper Enterprise

In this issue we publish the last of a series of articles on an enterprise that may fairly be regarded as the greatest copper mine in the world. It is a veritable mountain of copper ore and is yielding at the rate of 17,000,000 pounds of metal monthly. To those whose experience has been mostly in the winning of the precious metals, the sight of such a vast reserve of ore is astonishing. Usually the more difficult part of mining is to find the ore; it is to the uncertain distribution of gold and silver in veins and lodes that the speculative character of precious-metal mining is due. The search for ore overshadows the question of exploiting it cheaply. On the other hand, a mining engineer looking at the Utah Copper mountain realizes that the anxiety as to quantity is removed, all that remains is the application of skill in breaking, moving, and beneficiating the ore so cheaply as to ensure a profit large enough not only to amortize the capital required to establish systematic industry but to yield a profit commensurate with the financial risk involved in such an undertaking. The prospector stands aside; the engineer steps forward. Then is realized the definition of engineering as used in the charter of the Institution of Civil Engineers: "The art of directing the great sources of power in Nature for the use and convenience of man." The force of gravity, the energy of falling water, the heat latent in coal, and the expansion of steam are harnessed, like a quadriga, by him, in order that he may quickly and easily, and therefore inexpensively, break the metal-bearing rock, transport it, crush it, and subject it to a number of complicated processes so that at the end of a series of operations he may have marketable ingots of pure metal. Such are the operations that we have passed in review. The cost has ranged from 8.85 cents per pound in 1908 to 6.95 cents in 1916, rising, in consequence of war conditions, to 10.995 cents in 1917 and to over 17 cents per pound during the latter part of 1918. The profit has not paralleled the cost because the price of copper, ranging between 12 and 32 cents per pound during ten years, has been a decisive factor, compensating for the higher cost of war-time. The profit in 1914 was only 5.22 cents, as against a maximum of 19.22 cents per pound in 1916. In 1918 the profit will probably be between 8 and 9 cents per pound and the output about 203,000,000 pounds from about 12,600,000 tons of ore. The splendid earning capacity of the property has been obtained at the expense of metallurgical thoroughness. The prime purpose of mining is to make money, therefore the most efficient metallurgical practice is that which yields the largest dividends, making due allowance for the earning power of money and the prospective life of the mine. In Europe mines may be run with an eye to the interest of posterity; in this country our perspective is shorter and more practical. Shareholders prefer to re-invest their own winnings rather than postpone them for the enjoyment of their children or grandchildren. Hence methods that to a philosopher seem wasteful. The accumulation of residual tailing may become a source of revenue to others in days to come, the discard at the mine may prove attractive to the more skilful operator of a later period, but the salient fact is that the ore deposit is now being exploited in a manner likely to give the largest revenue to the present proprietary. That suffices, and more than suffices. To the daring and initiative that conceived the various stages of development and equipment the author of the articles has paid just tribute. The Utah Copper is an epitome of Western energy, resourcefulness, and persistence. To the end of the current year the mine will have produced 80,000,000 tons of ore averaging 1.4% copper, enabling the company to pay $92,015,782 in dividends and to accumulate nearly $50,000,000 in working capital, thus showing a total profit of $142,000,000 in eleven years. The figures are eloquent; they speak for the skill in controlling men and things that has been applied by Messrs. D. C. Jackling, R. C. Gemmell, George O. Bradley, Frank G. Janney, and the staff of young men whom they directed to this great accomplishment.

The Market for Silver

The Editor:

Sir—Of the 350,000,000 silver dollars authorized to be withdrawn by the Walsh-Pittman Bill, the United States Mint reports it has melted down 194,189,374 dollars up to October 1, 1918, and it has been estimated that by January 1, 1919, the remaining 156,000,000 dollars will have been melted down into bullion for export abroad. During the three months ending August 24, 1918, exports of silver were at the rate of 35,000,000 oz. per month or 420,000,000 oz. per year. That this rate of export will soon exhaust our supply of silver and cannot be maintained is self-evident when it is known that the annual production of this country is but 72,000,000 oz. We have been exporting nearly six times as much silver as we produce and our surplus stock of silver, the 350,000,000 dollars that were in the Treasury, will have been exhausted by January 1, 1919.

The average yearly production of silver for the whole world during the past three years is about 160,000,000 oz. It is estimated that all of 30,000,000 oz. annually is consumed in the arts and moving picture business. This estimate would leave but 130,000,000 oz. annually to meet the requirements of the world's mints for monetary purposes.

India is known as the 'sink' for silver. The average annual imports of silver into India for the 15 years beginning April 1, 1901, to March 31, 1916, was 83,136,000 oz. The average annual export of silver out of India for the same period of time was 16,530,000 oz. The excess of imports over exports was 67,606,000 oz. per year. This is why India is known as the 'sink for silver', for this metal never again re-appears in the markets of the world. During the 15 years considered above, over one billion ounces of silver has disappeared into this sink, never again to appear in the world's markets, and this same process has been going on for much longer than 15 years, and in all probability will continue at an increased rate in the future.

Subtracting the 67,606,000 oz. absorbed yearly by India from the 130,000,000 oz. of the available world's supply, after the demands of the arts have been met, we have 62,394,000 oz. left with which to meet the demands of the rest of the world for coinage purposes. How far this amount will go toward this end is indicated by the following figures.

The world's demand for silver for coinage purposes, outside the British Empire, has averaged for the period of 15 years, 150,000,000 oz. annually, or more than twice as much as will be available at the present rate of production after the demands of India and the arts have been satisfied. Re-coinage of old and mutilated coins and old silverware and jewelry has probably supplied 25,000,000 of this demand, reducing the actual amount to about 125,000,000 oz. Summing this up we have as follows:

	Oz.
World's demand for coinage, new silver annually	125,000,000
Arts and moving pictures, new silver annually	30,000,000
Absorbed by India, new silver annually	67,606,000
Annual demand for new silver	222,606,000
World's present rate of production	150,000,000
Deficit in production	72,606,000

The above facts and figures clearly indicate the favorable position in which the producer of silver is placed today. There is a deficit in production of 72,606,000 oz. annually at a time when all indications point to a greater demand for the metal than was ever known before. These figures indicate that the price of silver will not fall below the current quotation and lend additional strength to the current belief that the price of the metal will, when again governed by the laws of supply and demand, advance still higher in price. That there are additional grounds upon which to base this belief is shown by the following table of the world's yearly production and the average London prices per ounce in terms of United States currency:

Year	World's production	Average price per ounce cents
1911	226,000,000	53.928
1913	223,000,000	60.458
1915	178,000,000	51.892
1916	156,000,000	68.647
1917	150,000,000	81.417
1918	143,000,000	96.772

Thus we see that since 1911 there has been a steady decrease in the production of silver in spite of a steady increase in price. Certainly, if figures can be relied upon, these figures show that the most prosperous period the silver miner ever knew awaits him, even if there were to be no greater demand for the metal in the future than there has been in the past.

There is every reason to believe that there will be a greater demand for silver. As one of the results of the War, the standard of living in the Orient has been raised. The Orient has grown rich through supplying the needs of the Allies. The wants of the Orient will increase steadily. England is reported to have put 1,500,000 Hindu soldiers under arms; these troops have been out of India most of the time and have been introduced to new and strange commodities and ways of living; they will introduce them at home when they return. Thou-

sands of Chinese have been used by the Allies back of the battle-lines; these men will be returned to their country and introduce new wants among their people. This means a steadily increasing demand for silver for this new wealth and higher standard of living will enable the Orient to absorb it in greater amounts than ever before.

The above facts and figures explain why China is offering $1.16 to $1.20 per ounce for silver and cannot get it. As soon as the war restrictions are removed by the Government, silver will advance in price because England, the United States, India, and the Allied nations will then have to compete in the open market with the rest of the world for silver, the present rate of production of which is shown to be abnormally low. After the first of the year the 350,000,000 silver dollars that were in the American Treasury will be gone, and there is no other large stock available.

The Walsh-Pittman Bill was rushed through Cangress. There was no opportunity given the mining men to protest against it, if they had been so inclined. They knew that the price at which this silver was to be sold, $1 per ounce, was below what it will cost to replace it, but with them it was anything to win the War. A promise was made them that eventually this silver would be replaced in the Treasury. This means that the United States must become a large buyer of silver for many years in the future, in competition with other buyers of the world. Truly the position of the silver producer would seem to be the brightest it has ever been. A revival of silver mining is in sight.

M. T. Chestnut, Jr.

Denver, Colorado, December 12.

[The silver market is sensitive in spite of Government support. On September 3 the British Treasury, following the action of the United States, fixed the maximum at 49½ pence. Reduced rates of war-risk insurance caused a fall of ¾ pence in London on November 12. The British Treasury immediately fixed a new maximum at 48¾ pence. Unseasonable weather in India has caused a recent slackening of demand for silver.—Editor.]

Platinum in British Columbia

The Editor:

Sir—Having, with a partner of mine, spent over four hundred dollars and three months time—to say nothing of breaking up a school-year at Washington State College—in grubstaking Mr. J. C. Reilly and in prospecting myself for platinum on Olivine mountain in British Columbia, the discussion regarding it interests me considerably. Professor Kemp, in U. S. G. S. Bulletin No. 193, tells in minute detail the story of the platinum-bearing chromite in the basic eruptives of Olivine mountain. His conclusion, as emphatically corroborated by my experience, is that the chance of finding platinum in sufficient quantity to mine is very small. Just consider the fact that this area of from 30 to 40 square miles of platinum-bearing eruptives (olivine, pyroxene, serpentine, etc., has yielded through all the ages it has been wearing away, in the creeks that flow from it, a concentration of much less than a million dollars worth of platinum. The scores, perhaps hundreds, of residents of Hedley, Princeton, and other towns on the upper Similkameen river, who have been 'stung' with 'platinum claims' and 'diamond claims' on and around Olivine mountain, must certainly feel the same way about it.

C. Roy Price.

Martinez, California, December 10.

P. S. A pertinent comment on this subject is to be found in the fourth paragraph on page 537 of 'The Mineral Industry' for 1901.

Conditions in Russia

The Editor:

Sir—The Allies have been policing certain notable parts of China since 1900, and, to some extent, previous to that date. There have been, in the region of Tientsin and Peking, an average of 5000 foreign troops constantly during this time, the reason for this being the instability of the Chinese government and the danger to foreign lives and trade if reliable armed protection was not available. Another object in leaving foreign troops in China has been to assure the uninterrupted operation of part of the North China Railway, extending from the port of Chinwangtao to Peking, about 200 miles, and to assure the safety of the foreign legations at Peking. In the case of Russia, we have a much richer and less developed country peopled by a white race, which, for many of the necessities and most of the luxuries of life, is dependent on the outside world. Most of the foreign trade of Russia previous to the War was in German hands. Bolshevism, with the aid of German organization, has utterly prostituted Russia. No general organized government exists. Thousands of the property-holding and business people of the country, as well as more of the poorer classes, have been foully murdered. Millions of dollars worth of property has been destroyed, hundreds of thousands of people rendered homeless, all manufacture stopped, all foreign trade, all government, except a few feeble local provincial administrations, have been absolutely disorganized. In some parts of the country food in plenty exists, and in others there is starvation. In Russia proper there is no sugar, leather, hardware, tobacco, or clothing, and in Siberia, which has had some communication with the outside world, the situation is but little better. Order is maintained in parts of Siberia only by the presence of Czecho-Slovak troops and a few Cossacks, with newly-organized and untried Russian levies and a handful of Allied troops. The people have neither the initiative nor the experience to organize a stable government or to police the country. What little initiative they had is gone; they are worn out and tired of the various untried doctrines and experiments in government that have been thrust upon them. They want only peace and someone to tell them what to do. There are no developed political parties with leaders capable of commanding re-

spect. The only apparent solution of the problem is for the Allies to unite and police the main lines of communication, see that provisions are distributed, and give the people a chance to recover and take up their own burden. We cannot afford to see one of the richest parts of the world turned into chaos or worse; we ought to go and show this people that we are going to stand for the square deal and honest administration by the actual presence of Allied forces. Also, we want a hand in the development of the country and in the trade resulting from that development. Russia, in its present state, or without Allied control, is, and will continue to be, a constant menace to the peace of the adjoining countries and to the world at large.

C. L. F.

San Francisco, December 10.

The Future of Manganese

The Editor:

Sir—Leonard G. Blakemore, in your issue of November 30, writes concerning the manganese situation from the producer's standpoint and asks why a tariff should not be placed upon manganese ore to prevent its importation. There are two chief reasons why a tariff will not be placed on this ore. In the first place, no matter how much tariff is imposed, no matter how much Government assistance is given, the United States holds no promise of ever producing an appreciable amount of high-grade ore. So far as investigations have gone it has been proved that no important bodies of high-grade ore exist within our territory.

In the second place, there were less than 150 properties producing ore of 35% MnO_2 or better six months ago and they averaged only about 200 tons per month each, which means that a very small number of persons was engaged in its production, while there are many thousands interested in the consumption of the metal. It is contrary to the prevailing spirit in America to tax the public permanently for the benefit of a few. I am one of 150 stockholders in a small gold mine; 150 of us as stockholders and as many more dependent upon the mine for a living, are using manganese-steel in the crushing of our ore; we have seen the price of this advancing for several years; to be sure, it is not a large item on our expense-sheet, but only one of those the sum of which is now making our gold cost pretty close to $20.67 per ounce. Three hundred of us believe that the price of supplies, including manganese-steel, ought now to be coming down. If they do not we will simply have to quit; naturally we are going to object most strenuously to the imposition of tariffs that will tend to keep up our high cost.

The manganese producer occupies the same position as the producers of hundreds of war-time articles, the production of which must cease when the market for the high-priced article is gone. We do not live in a charitable, altruistic world, but one where the survival of the fittest is the inflexible rule. Within a few months' time Brazil, India, and Russia will, as formerly, be supplying us with the greater part of our high-grade manganese ore and Mr. Blakemore's mine will be closed, as will have been my gold mine without the fall in prices.

F. F. S.

New York, December 6.

The Chrome Scandal

The Editor:

Sir—I wish to thank you for your frequent and timely editorials on the subject of the chrome scandal. I have had occasion to follow closely the course outlined by the Government in the early encouragement of chrome mining, especially since this company received direct assistance through members of the Bureau of Mines, in starting an enterprise in Oregon for the purpose of producing chromite.

I can verify the article in your recent issue of December 7 for the reason that owners of undeveloped chrome properties were verbally induced to lease their holdings to us because we were known to the Government as operators who would perform in accordance with our contract. We offered a fair royalty, which was declared by representatives of the Government to be just, and property owners were recommended as a patriotic duty to offer us leases. Complying therefore with the Government's encouragement and recommendations, we undertook the operation of several tracts and purchased therefor some very expensive concentrating machinery. This equipment has reached the point of operation and is ready to be set up. About this time, however, the market began to decline and we found we were unable to obtain long-term contracts. Shortly the armistice was signed, and the chrome market fell to pieces.

Up to the present time we have over $25,000 invested in equipment, advance royalties, engineering and traveling expenses, metallurgical tests, etc. When the United States government admits its moral responsibility to the chrome producers, and still refrains from taking any constructive action for the effective re-building of the industry, we must come to the conclusion that the right way out has not been suggested and approved. I have read of the cancellation of munitions orders which were issued and have been followed up by competent members of the various Government departments who undertook to appraise the amounts actually invested by private capital in carrying out the orders which had been issued. A nominal profit of 10% was then allowed, and the cost and profit together formed the basis of the Government's obligation to the holder of the contract.

Why could not the Government work out some such adjustments in the chrome industry, either under a technical interpretation of the phrase "for the National security and defence" or some other clause of the Minerals Control Act, or, if the Minerals Control Act is not subject to such interpretation, why not pass some legislation to permit Government obligations to be met in the manner above suggested?

I desire to promote discussion on constructive lines in order that all phases of the chrome situation can be

brought to the attention of the proper authorities in order to secure remedial action for a much distressed industry.

JUSTICE F. GRUGAN,
Chief Engineer to the Suffern Company.

New York, December 11.

Why Not Domestic Ores First?

The Editor:

Sir—Mr. Blakemore's letter under the above heading in your issue of November 30, respecting the protection of the manganese ore mines, suggests this thought: which predominated when he invested in his mining plant, the idea of making a large profit quickly or patriotism? We can conceive of only these two reasons for his having gone into the business; they are distinct, and one man could not have held both at the same time.

If the former, he used his best judgment, taking not only the ordinary mining risk but a war risk in addition. He knew that if he could get going quickly and the War lasted for some time he would be handsomely paid for his risk; he also knew that the day peace was declared the bottom would fall out of the manganese ore business. It may be a new experience for Mr. Blakemore to be stung in the mining business; I have been hit several times, but it had not occurred to me to ask the Government to make good my losses. It may be that Washington will be good to Mr. Blakemore, but I doubt it.

If it was patriotism that induced some miners to go into the mining of manganese, that is quite another matter; we sympathize with them as we sympathize with others who have given property and life for the cause of liberty, but patriots are neither asking for sympathy or the return of their money or their dead. They gave freely, they were happy that they could give, and they have charged up their losses as their 'bits' in the winning of the War.

A. MINER.

New York, December 6.

[This is not altogether fair. A man may have started to dig manganese ore with mixed motives, partly for gain and partly for patriotic purpose. Not many men know the exact motive from which their action springs. Even 'patriotism' can be viewed as a selfish gratification of sentiment. No, we disagree with the criticism of Mr. Miner.—EDITOR.]

A Friendly Greeting

The Editor:

Sir—Your subscribers are greatly indebted to you for the highly patriotic editorials presented through your columns during each phase of the War and for re-publishing articles of such enormous value as that of 'The Battle of the Hindenburg Line', which otherwise might have escaped notice. Now that we are entering the reconstruction period, even greater precaution will be necessary on the part of all patriotic engineers, because of the unceasing and continued efforts of the Emeny to take advantage of the restraint that has been thrown off by reason of the armistice.

Some few of us that have been called upon to take the place of Germans in the past years, know the insidious character of our enemy, probably better than younger engineers. This is the time to be on guard at home—as well as in Germany—to ascertain in the questionnaire of each applicant for service that the applicant has not been a slacker at home, in the non-purchase of war stamps or bonds, if sufficiently able financially to do so. I personally know of such men in our midst. It is unfair to that vast majority of labor that has been so loyal, to employ such slackers, regardless of labor shortage, in the face of the great sacrifice that has been made by the brave boys that have given their lives that those that could not go might enjoy liberty.

Slackers of this variety should be banished from our shores because they evidently belong with the Bolsheviki, who were organized by Germany to exploit Russia, so successfully that its backfire is now reaching the place of origin.

Your reference to certain yellow journals is especially good. These have proved how close they could go toward meriting internment without actually being interned. This has emboldened them to use every effort, at the present moment, to produce friction between us and the Allies, and more especially between the United States and England. It is by such means that Germany yet hopes to win this war.

With the removal of the executive portion of our Government from Washington to Paris the reconstruction period indeed offers a problem that only the best posted men of the Nation can possibly save from another host of errors, if not from serious mishap.

W. W. WISHON.

Searchlight, Nevada, December 15.

CRUCIBLE manufacturers are now using 20% or more of domestic flake graphite in their crucible mixtures, so the demand for the domestic product has been rather stronger than it was during the first few months of the year, according to the U. S. Geological Survey. There appears to be a good demand for No. 1 flake of 85% carbon standard at 15 cents per pound, f.o.b. mines. The demand for the 90% grade is not so good, though some has been sold at the high price of 20 cents. According to a resolution of the War Trade Board dated November 7, 1918, the present import restrictions on graphite are to be continued in force until June 30, 1919, unless otherwise ordered by the Board.

OPERATIONS at the Philadelphia Mint of a 1000-lb. Rennerfelt electric melting-furnace has shown that melting silver, nickel, and bronze alloys by electricity is economical and saves both time and labor. Tests have been satisfactory, indicating savings in the cost of melting approximating 40%. It is proposed to establish electric-furnaces at the San Francisco and Denver Mints.

THE GARFIELD SMELTER OF THE AMERICAN SMELTING & REFINING CO. AT GARFIELD, UTAH

The Utah Copper Enterprise—IX

The Smelting of the Concentrate

By T. A. RICKARD

The products of the Arthur mill, as we have seen, consist of two kinds of concentrate, one made by water and the other made by flotation. These concentrates are mixed before being delivered to the filter-plant, so that the final output of the mill is a product containing, on average, during 1917 for example, 14.82% copper, 26.79% iron, and 21.69% insoluble, together with 13.6% moisture. The last item is of greatest importance to the smelter, as we shall see. Formerly the table concentrate and the flotation concentrate were shipped separately, the first containing about 8% and the second from 20 to 25% moisture. They used to be loaded into the cars together, not properly mixed, the consequence being that accurate sampling was rendered impracticable, for the flotation concentrate was much richer in copper, containing 20% as against 12% in the table concentrate. So it was decided to ship these products separately, in order to facilitate sampling, but the cars containing the flotation concentrate had to be left on a siding for a week or more in order to allow the water to drain. Finally the management at the mill devised the scheme of mixing the table concentrate with the flotation concentrate in the Dorr thickener before filtering, thereby yielding a product containing 16 to 17% moisture. This was material that, it was thought, could be sampled fairly well.

However, before discussing this tender subject further, let us go to the Garfield smelter, to which the concentrate from the Arthur mill is consigned under contract. This smelter belongs to the American Smelting & Refining Co., it is only two miles from the Arthur mill, and stands on the shore of Salt Lake, near Black Rock point. The Garfield smelter treats only custom ores. At the present time 60% of the gross tonnage of ores comes from the Utah Copper company. Only a small proportion of precious-metal ore, averaging 10 oz. silver, is included in the receipts, the richest containing 32 oz. silver per ton and being used in the converter owing to its high content of silica. The 24.6% insoluble in the flotation concentrate from the Utah Copper contains 6.7% alumina and 16.9% silica.

The manager of the plant, R. F. McElvenny, was most courteous, and A. H. Richards, the assistant-superintendent, was kind enough to conduct me through the works.

A car of flotation concentrate from the Ohio Copper company was being unloaded. It contained about 25% moisture, and while watching the shoveling one could realize what trouble the Utah Copper product used to give to the smelter people. The flotation concentrate arrives in flat-bottom cars having a floor of wooden slats on which cocoa matting is spread so as to serve as a filter through which the water can drain. The car arrives with a pool of water on top; in winter this takes the form of a cake of ice two or three inches thick. From November to March it is customary to run the cars into a thawing-house. This is a brick building provided with four tracks giving room for 12 cars apiece, so that 48 cars can be thawed concurrently. In this building is a pit covered with cast-iron (one inch thick), under which is a big brick flue through which hot air passes from a furnace fired with coal. A temperature of 110° is maintained. Usually 24 hours suffices to thaw the concentrate, but if

MAP OF PART OF UTAH, SHOWING THE POSITION OF GARFIELD, ALSO THE MAGNA AND ARTHUR MILLS

it is frozen solid, the period of thawing may be lengthened to two whole days.

The unloading is performed under contract with gangs of Greeks, also a few Japanese. These men expect to earn from $6 to $7 per day, for they work hard. The price for unloading concentrates from the Utah Copper mills varies with the moisture; for table-concentrate it is $9.60; for mixed table and flotation concentrates it is $11.50; and for straight flotation concentrate, $13.35 per railroad-car. The price of $11.50 for the mixed product was maintained only during a short period, because this material was so sticky, the unloaders insisting that it was as bad as the unmixed flotation concentrate, so that recently $13.35 has been paid for unloading the mixed concentrates. Since my visit a general rise in wages has lifted the contract prices to $10.60, $12.50, and $14.35 for the three classes of material; and, as a matter of fact, it has been found necessary to pay $14.35 on all the concentrates. A car holds 70 tons and the crew that does the shoveling consists of 8 men. The price is determined by agreement before the job is tackled. In order to ascertain the proportion of moisture, holes are dug into the concentrate at two points, each one-third of the distance between the centre and the ends of the car. Both holes are dug right down to the bottom of the car and a sample is taken from each hole by means of a spoon or scoop, which is an inch wide, three inches long, and is provided with vertical sides that give a depth of one inch. In taking this moisture-sample a uniform slot is cut on the face of the hole from the top of the load of concentrate to the very bottom of the car. While visiting the unloading-shed, above the receiving-bins, I found that a gang of shovelers had struck, demanding $13.35 for unloading a car of Utah Copper concentrate that happened to be unusually wet. It was, they claimed, a load of flotation concentrate unmixed with table concentrate. These men knew the difference. They stopped work, but the difficulty was adjusted later.

Every tenth shovel from the railroad-car is thrown onto a platform where it is half-shoveled twice, one quarter being shoveled into a car that delivers it at the sampling-room. From a small bin it is drawn onto a steel floor, upon which it is reduced by successive quartering to a sample of 200 pounds. The operator throws every other shovelful into a wheelbarrow in order to decrease the labor involved, the stickiness of the concentrate rendering it impracticable to make a regular cone. He simply shovels toward the centre, makes a heap, and then flattens the mass, using an iron sector to mark the quarters.

From the receiving-bins the ore is conveyed on a belt to the bedding-bins, whence it is discharged into lorries. Each of the four bins is 20 ft. wide and holds 7200 tons, occupying a building that is 80 ft. wide by 540 ft. long. The discharge is done by using a pick to move the boards on the bottom of the bin, which are made hopper-bottom by allowing the ore to collect at the sides. Five men are employed to empty the bin and load the lorry.

A 10% addition of silicious oxidized ore, containing 50% SiO_2, is added to the concentrate in these bins. Lime, in the proportion of 10%, is added on the fifth hearth of the roasting-furnace, so as to obtain an intimate mixture. The lime used at this smelter is in the form of sand from the shore of the big lake, a deposit of it having been discovered and first used by W. H. Howard in 1909. It contains 48% CaO and 9% insoluble.

In approaching the roaster I heard a noise that furnished further evidence of the difficulties made by the millman for the smelter. Three men were engaged in hammering the lorry, one poking with a crowbar from above, while two were hitting the sides with a special implement, namely a bar having a knob at each end. Thus even in summer the stickiness of the concentrate gives this further trouble. In winter the difficulty of unloading the electric lorry is increased, of course. It appeared a pathetic performance in this age of proud efficiency, but I confess that by this time my sympathy had

UNLOADING FLOTATION CONCENTRATE AT THE GARFIELD SMELTER

veered to the smelter-people, who, it seemed to me, were called upon to overcome difficulties that had been passed to them from the mill. Mr. Richards informed me that his operations were curtailed frequently, especially during winter, by the inability to get the concentrate out of the railroad-cars and then by the difficulty of feeding it to the roasters; even after it has been mixed with 10% of silicious ore, it is difficult to ensure a uniform feed to the furnace. This is true of operations during the winter, but in summer also there is trouble in feeding concentrate to the roasters. In a recent letter from Mr. Richards he says: "I was over to the roasters this morning and found that the product we are now receiving is 'bridging' in the hoppers of the Call-Wagstaff furnaces. You will recall that this set of roasters has the apron-feeder underneath. I counted no less than 12 men poking the charge out of the hoppers, so as to get it into the roasters, and even at that our reverberatories were curtailed owing to not being able to obtain sufficient calcine." No metallurgist can refuse his sympathy to a superintendent compelled to roast undried flotation concentrate.

New cars are to replace the lorries now in use; three of them will constitute the train to be pulled by the electric locomotive; they will carry 20 tons divided in two compartments, having vertical sides, so that when the bottom drops the load will fall promptly.

Of the various feeders, the Stevens-Adamson apron appears to work best on wet material. This feeder has a storage-hopper, two sides of which are vertical, whereas the other two slope at 70°. A 40-in. belt of overlapping corrugated steel slats 4 in. wide moves the ore, the flow of which is regulated by a gate, giving an opening 12 in. high and 36 in. wide. I saw what an inefficient feeder, of another type, will do. The concentrate stuck so as to bridge the opening and stop the feeding.

The roasters at Garfield are of the McDougall type, with rabbles having straight blades set at 45°, except on the top hearth, where the angle is 60°. The blades have a 3-in. sweep and are 6 in. apart. In order to prevent clogging by the flotation concentrate, it is proposed to widen the blades from 7 in. to 11 in. on the topmost hearth, where four arms with rabbles spaced 9 in. apart are in use. The roasting-plant contains 48 furnaces, divided as follows:

10 Herreshoff furnaces, with seven hearths of 19½ ft. diameter.

8 Call-Wagstaff furnaces, with eight hearths, also 19½ ft. diameter. This furnace was designed by R. A. Wagstaff and B. G. Call, members of the staff.

16 McDougall furnaces, of six hearths, 18 ft. diameter.

14 McDougalls, six hearths, of 19½ ft. diameter.

The cars that take the roasted ore to the reverberatory furnaces are not covered. Hereafter, while being loaded they will come under a hood that has an opening, with a slight suction into a flue, for the collection of dust. This arrangement is not yet in use, but it has proved successful at the Tacoma smelter. Hoods have been built above eight new roasters and provision made to connect these hoods with the flue, but this improvement is being delayed by the need of covered calcine-cars. It is intended to cover the cars and to double their size; also to provide a tight connection between the hopper of the reverberatory and the car. All such betterments are delayed by the inability to obtain quick delivery of material. In these matters of dust-control the International smelter at Miami is so much better equipped that I venture to

express surprise at the fact that the experience obtained there had not been utilized at Garfield. In my article describing the International smelter I gave details and also drawings of the appliances there in use.[1]

The feed to the roasters contains 14 to 16% copper, with 29 to 30% sulphur. After roasting it contains 16 to 18% copper, with 10 to 12% sulphur, having lost 12% moisture. The roasted ore is smelted in reverberatory furnaces, fired with pulverized coal, yielding a matte containing 42% copper and 25% sulphur. About 10% of the sulphur is eliminated in the reverberatory. The matte is treated in converters that yield blister copper 98% fine. This goes to the refinery at Baltimore, Maryland.

A question arose among our party as to the proportion of power used in the various stages of treatment to which the Utah Copper is subjected. It was ascertained that the refinery produced 170 lb. copper, the smelter 80 lb., and the concentrator 34 lb. per kw-day.

Returning to the question of moisture in the concentrate, it used to be the practice at Garfield to unload it upon belt-conveyors and bed it directly with the crude ore going to the blast-furnaces. At times as much as 10% of the blast-furnace charge was flotation concentrate, but the loss in dust was excessive. At the time of my visit shipments of flotation concentrate were being received from the Engels Copper Mining Co. in California. In order to minimize the cost of transport, this company reduces the moisture as much as is practicable, bringing it down to about 9%, which makes it slightly dusty. Apparently a 10% moisture is low enough for operations at the smelter.

On enquiry I was informed by Mr. Elmer E. Paxton, manager for the Engels company, that two Oliver filters are in use in his mill and that the dewatering of the concentrate is facilitated by a liberal use of steam, in three ways: (1) Steam is introduced through the emergency pipes, the air being excluded occasionally while the steam is admitted to the lifts. (2) Steam is forced through the feed-pipe to the bottom of the settling-tank, so as to warm, but not agitate, the concentrate just before a charge is drawn from the settling-tank into the filter-tank. While one charge is filtering, the next is being warmed. (3) A strong jet of steam is applied, through a pipe and hose at the back of the filter, so as to loosen and warm the bank of concentrate that forms in the bottom of the filter-tank. Thus the moisture in a two-inch cake is reduced as low as 10%. The average moisture in the concentrate shipped during May was 11%, this being reduced, by evaporation, to 9.5% by the time the concentrate reached Garfield.

The Ohio Copper company, at Bingham, has adopted the Lowden dryer. This machine is manufactured by the Colorado Iron Works, at Denver. It is designed to treat plastic material, such as flotation concentrate, without excessive loss in dust. The dryer consists (See Fig. 1, 2, and 3) of a single hearth made of cast-iron plates *A*, beneath which is the flue *B*, through which the gases of combustion pass. The feed is moved forward by means of rakes *C*, bearing rabbles *D*. These are right and left hand, in order to impart a ploughing action and distribute the material over the hearth. After the forward stroke, the rakes lift and clear the top of the material for the return stroke. The rakes move close to the hearth, preventing any caking, which would hinder the transmission of heat. The 'balling' of the plastic concentrate is minimized by the fact that the length of the stroke is less than the distance between the transverse rows of rabbles, so that, in descending, they enter the material where it has been left in ridges by the preceding stroke. Any lumps are broken by a roller placed between two

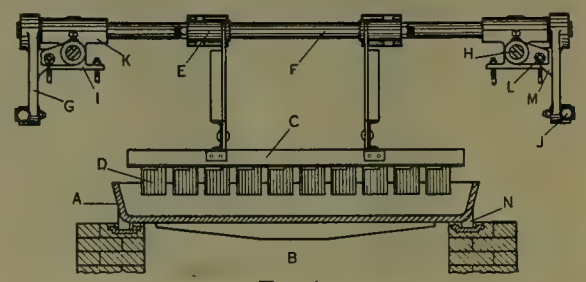


FIG. 1

rows of rabbles at the point where such lumps are in the most friable condition. Ample provision is made for expansion and contraction wherever parts are exposed to

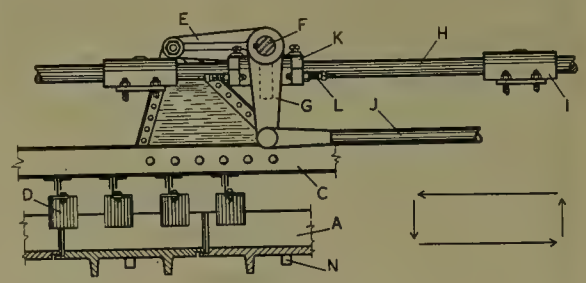


FIG. 2

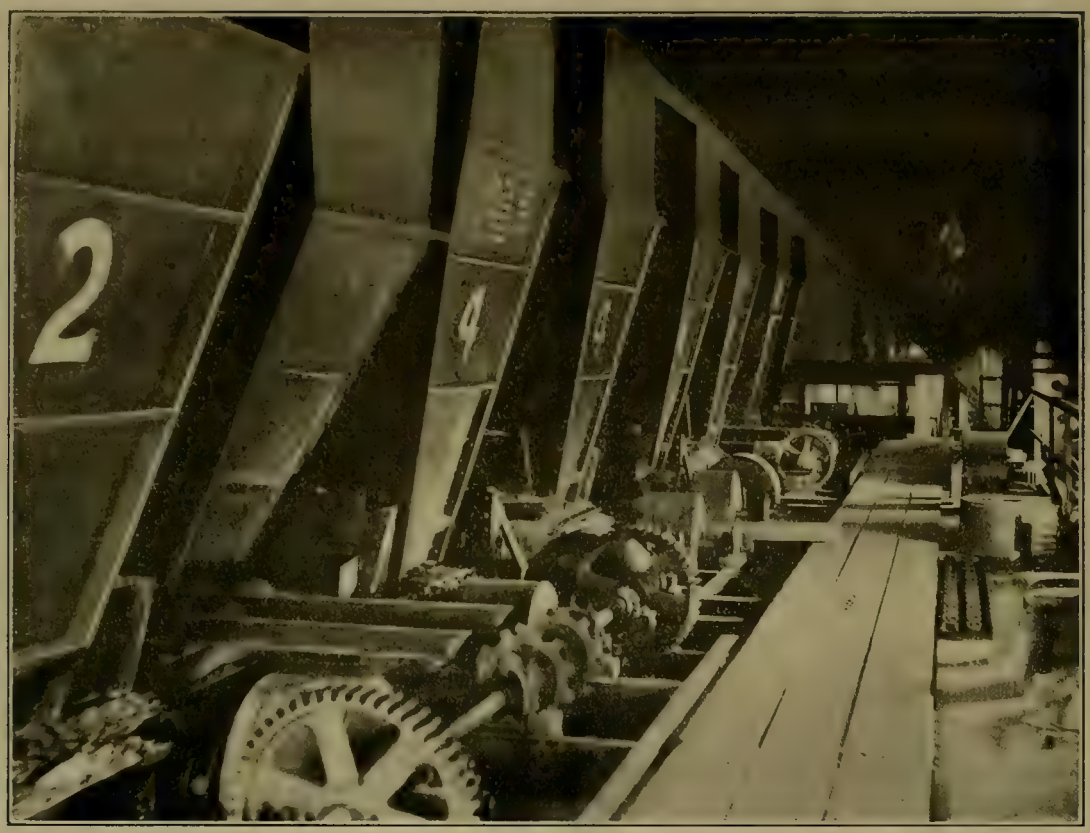
heat. The following data show the results obtained in practice at three plants:

Company	Moisture in feed %	Moisture in product %	Coal per ton of dry solid lb.
Federal Lead	15	5	117
St. Joseph Lead.....	16	5	125
Vindicator Consolidated..	29	13	128

In each case the temperature of the feed was 55°, and that of the product 212° F., or the boiling-point of water. The concentrate from the Ohio Copper mill contains 12% moisture, with which the superintendent of the Garfield smelter is quite satisfied. On the other hand, Mr. Janney tells me that the moisture in his concentrate during April averaged 12.83%, in 425 cars containing 30,898 tons, each car carrying 72.7 tons wet or 63.36 tons dry. Apparently the stickiness of the Utah Copper product is due to the large proportion of insoluble matter in the concentrate produced by the pneumatic flotation-cells.

This problem of drying flotation concentrate, so as to

[1]See M. & S. P., December 1, 1917.



A BATTERY OF STEVENS-ADAMSON FEEDERS

deliver a product suitable for unloading, conveying, and sampling at smelters, must be faced. So far, whether at Miami, at Ray, or at Garfield, the mill-people have 'passed the buck' to the smelter-people, who are tied by contracts that were signed before the true character of flotation concentrate was appreciated. I find that as between the managers of mills and smelters, the former always deliver a product containing less moisture than the same product contains on arrival at the smelter, despite such drainage and evaporation as may ensue in course of transit. This is a discrepancy that may be due more to a human factor than to one that is technical. It would be to the advantage of all concerned if the concentrate could be turned out in a form convenient to handle. Meanwhile the experiment being made with the dryer at the Ohio Copper is most interesting; there the dryer is placed at the discharge from the filter, as it should be, so that the concentrate drops from the filter upon a hearth of the same width as the filter. I may add that a rake-conveyor was used to cool and convey hot material from the Argall roaster at the Portland mill near Colorado Springs, in 1902.

Would nodulizing be advantageous? That would be the next step after drying. Nodules of, say, half-inch size, would be most convenient to handle and would give a feed suitable for the reverberatory or even the blast-furnace. At Braden the flotation concentrate is adapted for the blast-furnace by nodulizing in rotating kilns,[2] heated by oil-burners to a temperature of 1750°F. The sandy concentrate, containing 17% silica, is heated to a

CLOSE VIEW OF CONCENTRATE FEEDER

sticky consistence, due partly to the combustion of the part of its sulphur content, so that the rolling motion causes it to ball into nodules. The kilns are sloped an inch per foot toward the discharge, from which the red-hot nodules drop upon an endless chain of cast-iron pans,

[2]M. & S. P., February 12, 1916.

which convey the product to hoppers that feed the blast-furnaces. In the course of this process the sulphur is reduced from 28% to 18%, and, of course, the moisture has been evaporated.

Nodulizing has been tried also by the Canada Copper Corporation at Princeton, British Columbia, by R. M. Draper.[3] A rotary kiln borrowed from a cement plant was used. The kiln was 7 ft. wide and 125 ft. long, or about 25 ft. longer than was required for the nodulizing of the copper concentrate. About 82% of the sulphur was retained in the nodules, this being important in a region where the sulphur is required for smelting. Pulverized coal from a neighboring mine was the fuel used, the kiln itself being operated by electric power. It was estimated that a 100-ft. kiln of this type would nodulize 100 to 125 tons of flotation concentrate in 24 hours. At Chrome, New Jersey, a similar experiment was made, by Mr. Draper, on flotation concentrate from the El Cobre mine, in Cuba. The consumption of oil, as fuel, was 6 to 7 gallons per ton of concentrate. The nodules proved satisfactory for blast-furnace smelting when charged cold, but there was trouble with crusts on the furnace when too much of the hot nodules was introduced, owing probably to the fact that "they were near the smelting-point when charged into the furnace and naturally smelted much higher up in the furnace." I quote Mr. Draper. The concentrate averaged 30% sulphur, whereas the nodules averaged 14%. One sample of nodules chilled immediately in water had a sulphur content of 20%. A screen-test of the nodules showed that all the product was under half-inch, but only 4.78% was finer than 16-mesh.

Desulphurization would accompany nodulization. A product containing 10 to 11% sulphur and about 16% copper would be most suitable for making a 40% matte. Unless desulphurized sufficiently the delivery of nodulized concentrate at the smelter would conduce to a low temperature in the roaster, so that the smelter-people would not regard this step as an advantage. In short, if any desulphurization is to be done at the mill, the operation must be completed to the point of rendering unnecessary any further roasting at the smelter itself. Moreover, the smelter company, in making a rate for treatment, includes a charge for expelling both the water and the sulphur in custom ores; it would lose this source of profit if the preliminary operations were performed at the mill. On a long haul, like that of the Engels product, the removal of both moisture and sulphur would effect a considerable economy. Thus there are various conditions, technical and commercial, to be considered.

One would expect to find the Cottrell precipitator attached to the roaster, but at Garfield this precaution is only applied to the converters. How great the loss of copper in dust from the dryers would be, for example at Miami, if the Cottrell tubes were not used, was shown to me by L. O. Howard, the superintendent, who had the electric current turned off for a minute so that I might see the effect, which was to change a nearly colorless smoke into one heavily laden with dust. At Miami the flotation concentrate is not desulphurized, only dried, in the roasting-furnace.

At the Nevada Consolidated smelter, at McGill, Nevada, the gases from the roaster contain such an excess of water, owing to the high proportion of moisture in the concentrate, that it tends to condense with the sulphur tri-oxide, forming sulphuric acid, which attacks the brick of the flues and the iron of the jack-arches. At Garfield such trouble is avoided by causing the roaster gases to join the reverberatory gases, thereby maintaining a high temperature. The withdrawal of too much heat from the stack affects the dispersion of the fume and is likely to cause the destruction of vegetation. The wise smelter-manager avoids trouble in that direction.

Evidently the technical staffs of the mill and smelter should co-operate to solve this problem of drying the concentrate. As the proportion of table concentrate decreases, and more slimy flotation concentrate is produced, this phase of flotation practice will increase in importance.

The smelter occupies a picturesque site. Looking northward, across the marshes, the pavilion and long trestle of Saltair can be seen projecting into the lake, and beyond them the mountainous mass of Antelope island, now remarkable for its herd of buffalo. Turning around to the overlooking Oquirrh range, the eye rests on the level contour of a bench of gravel and other parallel terraces, which suggest old shore-lines. Such indeed they are, harking back to a time humanly remote but geologically recent.

The greater Salt Lake of the olden time is known to geologists as Lake Bonneville, that being the name given to it by G. K. Gilbert,[4] who published a monograph on the subject in 1890, under the auspices of the U. S. Geological Survey. These former shores were noticed by the explorers of 1849 and 1850; they surmised the previous existence of a lake vastly larger than the present one. The drift-wood found on beaches five feet above the lake indicated the recent recession of the waters and suggested that a recession on a larger scale had caused a greater shrinkage of the lake in a former geologic period.

The Lake Bonneville of geology was named by Gilbert after Capt. B. L. E. Bonneville, an Army officer who explored this region in 1833 and made notes that were published, with a map, by Washington Irving, in 1842. Lake Bonneville flourished in Pleistocene time; it had a length of 346 miles, an extreme width of 154 miles, and a depth of 1050 feet; it covered 19,150 square miles, as against the 2170 square miles of the existing lake. For

[3] 'Nodulizing Flotation Concentrates'. 'The Canadian Mining Journal', August 1, 1918.

[4] He died, I am sorry to add, on May 1, 1918. In anticipation of his 75th birthday, on May 6, a number of his friends had arranged by correspondence to celebrate the event by a presentation. The 'Lake Bonneville' monograph is No. 1 in that series of U. S. Geological Survey publications, because No. 1 had been set aside for a treatise by Clarence King, who failed to write it, so 'Lake Bonneville', which was intended to be No. 9 or No. 10, was given the place of honor.

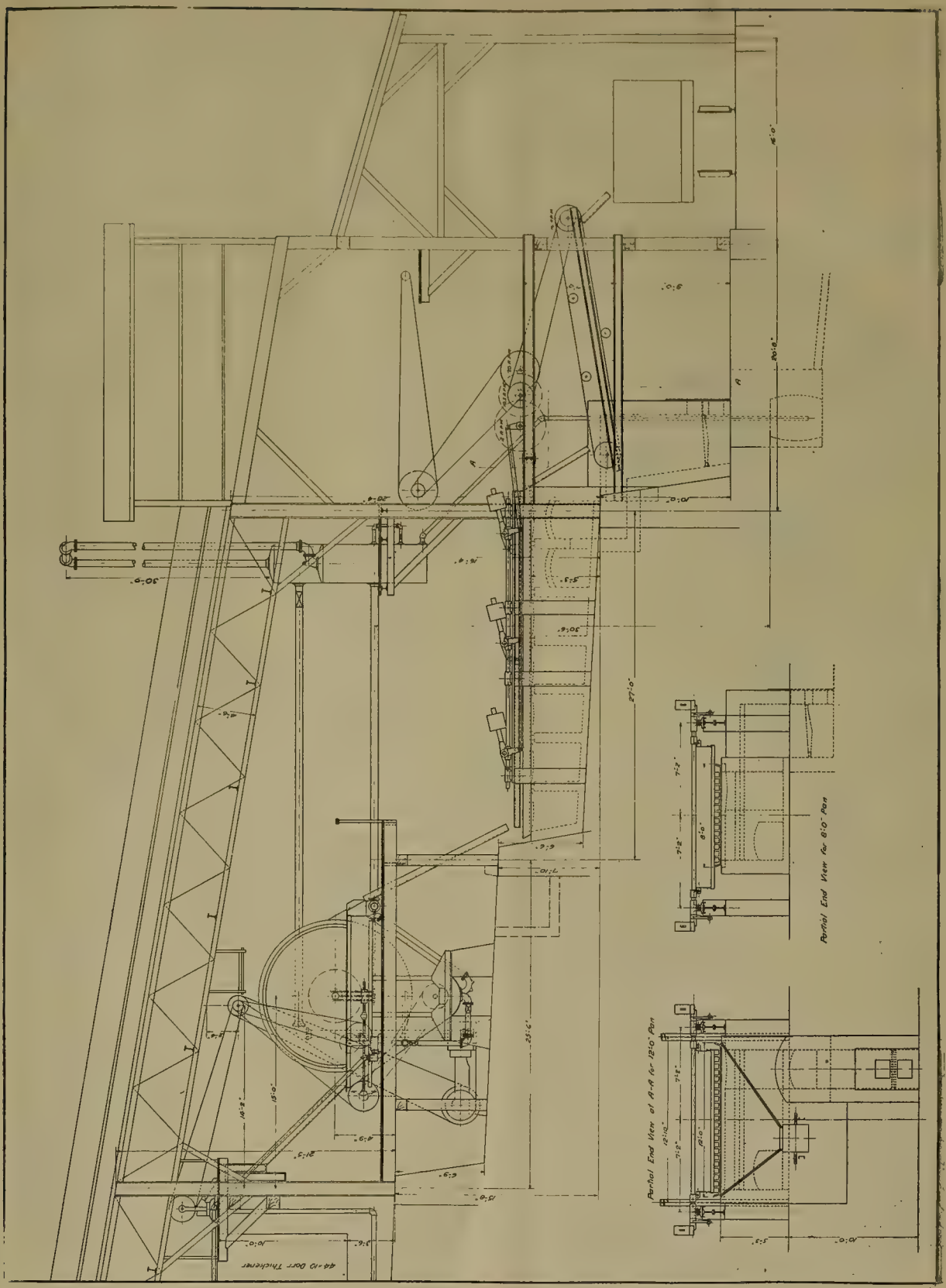


FIG. 3. THE LOWDEN DRYER, AS ARRANGED FOR THE TREATMENT OF FLOTATION CONCENTRATE

comparison, I may mention that Lake Superior covers 31,500 square miles and Lake Ontario 7250. The eastern edge of the old lake is now the granary of Utah. If the water were to rise to its former level, the Mormon temple in Salt Lake City would be submerged 850 ft. and Fort Russell would be 150 ft. below the surface. The area of

SHOWING THE EXTENT OF LAKE BONNEVILLE AS COMPARED WITH THAT OF THE EXISTING SALT LAKE

Lake Bonneville was diminished suddenly by an overflow that eroded an outlet through its rim at Red Rock pass at the north end of Cache valley. There the rim was a barrier of alluvium, instead of solid rock; the flood-water overflowed, a break was made, and a mighty river soon issued, causing a geologic debacle.

NOTES. It is interesting to note that the first contract with the American Smelting & Refining Co., for the smelting of the concentrate, called for 95% of the copper contents, as determined by wet assay; for 90% of the silver at the New York quotation; and payment for all gold contents of 0.03 oz. or over at $20 per ounce (that is, 67 cents less than its market-value). The base charge for treatment was $6 per ton, a minimum of $5.50 and a maximum of $7.50 being stipulated. At least 10% of iron over insoluble was guaranteed by the Utah Copper Company, "such excess to be considered neutral, and an allowance of 10 cents per unit for each percentage of excess over the guarantee." All insoluble in excess of iron was charged for at the rate of 10c. per unit. The charges for refining the blister copper were $30 per ton, besides a 2% allowance for loss in refining of the silver and a deduction of 13 lb. per ton for similar loss in refining of the blister copper.

In 1917 the two mills treated 12,542,000 tons at a cost of 69.3 cents per ton. The Arthur mill treated 5,464,800 tons, or an average of 14,972 tons per diem. The average grade of the ore milled at both plants was 1.337% copper and the average recovery was 61.1%, equivalent to 16.33 pounds of copper per ton of ore. In 1916 the average recovery was 62.34%, the poorer showing made in 1917 being due to unsettled operating conditions, the various improvements under way, and the lower grade of the ore. In the company's annual report, from which I get these data, it is stated that "the average normal and metallurgically economical capacity of the two plants during the year was about 24,000 tons per day, whereas in order to maintain maximum production of copper a daily average of 34,362 tons was milled." The cost of milling in 1917 was abnormal, owing to the higher costs of labor and supplies and to the large charges made for State and Federal taxes, which amounted to $4,381,205. At the Magna mill the cost was 62.28c. and at the Arthur mill it was 78.40c., as compared with 35.35 and 40.94c., respectively, in 1916.

ERRATA. In the second article of the series one or two errors and omissions were made. The later incorporation of the enterprise, in New Jersey, was made on April 29, 1904. No bonds were issued by the original company, which was registered in Colorado on June 4, 1903, for $500,000 in shares of $1 each. The present company, the New Jersey corporation, at the start issued 450,000 shares of stock at $10 per share and $750,000 worth of 7% bonds in full payment for all the assets and liabilities of the Utah Copper Company of Colorado. Colonel Wall received 20%, or $150,000, of these bonds. He also received 20% of the 450,000 shares of stock. Messrs. Cohen and Jackling received their commission in stock. The remainder of the bonds and stock went to the stockholders of the original company in order to reimburse them for the amount of money that they had paid to the vendor, Colonel Wall, and for the capital spent on the Copperton mill, as well as the development and equipment of the mine.

At the time of the incorporation of the present company, under the laws of New Jersey, the MacNeill and Penrose group held 67½% of the stock. In February 1907 Hayden, Stone & Co. underwrote the purchase of 60,000 shares of stock at $25 per share, making $1,500,000, and in January 1908 the same firm of brokers underwrote an issue of $1,500,000 of bonds convertible into stock at $20 per share, these bonds being sold in order to provide funds for expanding the capacity of the mill. Thus the capitalization of the company became augmented to $7,350,000. The working capital remaining on hand amounts to $48,293,528.

The Value of Gold in the Economic System

By HENRY STRAKOSCH

*The question has been raised as to whether any and, if so, what measure of relief should be given to the gold-mining industry. The answer must depend upon the view one holds as to the utility and value of gold to our economic system. If the view is held that gold is not necessary to that system, then mines unable to bear the stress of the situation have no more claim to relief than many industries that have suffered or gone out of existence owing to the War. The loss incurred by the owners merely forms a very small addition to the price we are paying for waging war to uphold liberty and justice in the world. If, on the other hand, it can be shown that gold is necessary to our economic system, then the question resolves itself into assessing its value to that system—as distinct from its price—and in devising a scheme that will most efficiently foster an increased production of gold.

The granting of a bounty by the Government on every ounce of gold produced in the Empire on condition that it is sold to the Government suggests itself as the best means of stimulating the production of gold and placing its control in the hands of the Government. Let us now examine what kind of bounty would tend most powerfully to stimulate the production of gold. For this purpose it is appropriate to divide the gold mines into the following three classes:

1. Developed and equipped low-grade mines that have already shut-down their operations or that are on the point of doing so owing to the increase of the cost of production.

2. Developed and equipped producing mines that have a sufficiently large percentage of high-grade ore to enable them to work these notwithstanding the increased cost.

3. Partly-developed and partly-equipped mines that, owing to the low-grade character of their ore, have been temporarily allowed to lie idle.

If the granting of a bounty were to be confined to the mines under Class 1, the effect upon the whole gold production would not be to increase it, but merely to retard its decline. If an increase in the gold production is aimed at, and in view of the needs of our currency and credit reservoir there can be little doubt about this being the right course, an increase can only be produced by stimulating production, not merely in the mines under Class 1, but under all three classes. The so-called rich mines are called rich, not because all the ore contained in them is of high grade, but because the percentage of high-grade ore is larger than in the poor mines. All three classes of mines—and especially those of the Central Rand—contain vast quantities of low-grade ore. The exploitation of these in the case of mines under Classes 2 and 3 will involve capital expenditure for additional development and milling equipment. It is obvious that such expenditure will not be incurred if there is not a reasonable prospect of it flowing back with an adequate return in the shape of profit.

A bounty, therefore, too closely circumscribed as regards its extent and duration, would not be conducive to capital expenditure being incurred. Such a bounty might, moreover, prove from its purely temporary character to be a curse in disguise, because the higher profit resulting would no doubt lead to greater demands from labor, the effects of which would probably remain long after the bounty was withdrawn. It seems, therefore, very doubtful whether a bounty extending over a short period would in the long run achieve the object desired.

The Excess Profits tax should be abolished as regards gold mines and gold-mining dividends, because of its strongly deterrent effect upon production. Gold mines are already specifically freed from colonial forms of this tax in some, if not all, of the Dominions, because the special case of gold is recognized.

To be of real use in properly stimulating the output of gold the bounty should, it is submitted, not only be of sufficient size and granted to all gold producers in the empire, but should especially be of a semi-permanent character not limited to the war period, but extending for at least 10 to 15 years after the conclusion of peace. The erection of additional plant, which will be necessary if the output of gold is desired to be increased, can hardly be expected before the War is over, and it must be assumed that it will take a matter of from two to three years from that time to complete it; so that if the bounty were fixed for a period of ten years from the declaration of peace there would only be left some seven to eight years within which to recoup the capital expenditure incurred.

To determine the size of the bounty, whether it is to be a fixed one or a variable one with a fixed minimum, and what that bounty proposed is likely to produce in the way of increasing the output of the Empire, are matters that will have to be closely investigated, but broadly speaking, the bounty should be adequate in amount so as to increase and not merely maintain the output of gold.

Let us now consider what the yearly expenditure by the nation on a gold bounty has to produce by way of benefits to the nation merely to pay for itself. For the purpose of illustration—and without in any way desiring to deal with either the extent or character of the bounty—let it be assumed that a bounty is granted of

*Excerpts from a pamphlet published in London.

12s.6d. per fine ounce of gold produced in the Empire, which is roughly equivalent to 4s. per ton of Rand ore milled, or just about equal to the increase in working-cost since July 1914. Such a bounty would involve the nation in an annual expenditure, on the basis of the 13,200,000 oz. produced in the Empire in 1917, of £8,250,000.

Take first of all the influence that an increased supply of gold has upon the value of money for purposes of Government borrowings. The £8,250,000 assumed above represents, roughly speaking, ⅛% reckoned upon the £6,500,000,000 of National Debt that will have to be funded. If the expenditure of £8,250,000 achieves no more than to reduce the market-value of credit for the purpose of Government borrowings by ⅛%, it would have paid for itself.

Applying the same reasoning to the question of foreign exchange, and basing it upon the assumption that we shall have to face for some years after the War an adverse net balance of trade of £150,000,000, the expenditure of £8,250,000 per annum would have paid for itself if it does no more than improve the value of exchanges by 5½%.

The benefits that this expenditure has to produce to pay for itself when looked upon from the point of view of cheapening credit for purposes of our commerce and industry cannot be expressed in figures, but it may safely be said that it need merely be trifling.

To base a system of bounty on gold upon the foreign-exchange position is tempting, because the price of our currency in foreign countries is the most ready means by which it can be demonstrated that by selling gold to the Bank of England at 84s.10d., the producers are not getting the full price represented by its value. It has been pointed out before that the potential value of gold rests, not merely upon its value for purposes of balancing foreign trade, but to an infinitely greater extent upon its use as a basis of our currency and credit system. It may be possible to right the foreign-exchange position with the gold that will be available in our currency reservoir after the War, but that may and probably would have the effect of so decreasing the amount of gold in the reservoir as to make the volume of credit that can be built upon it entirely insufficient for our needs. It would mean that the value of money would be raised, and probably very substantially. Recollect what happened in pre-war days. When in the autumn heavy imports of grain, cotton, etc., into this country took place from the United States, the New York exchange usually went against this country, indicating that we were not adequately balancing our trade by the export of merchandise or by receipt of revenue from the States. Consequently gold flowed out of the Bank of England to the United States. The mere prospect of this happening drove up the value of money in Lombard Street, and sometimes even induced the Bank of England to raise the bank-rate. This clearly demonstrates that to base a system of bounty upon the foreign-exchange position does not adequately meet the position, because a bounty determined upon rates of exchange takes no cognizance of the value of gold for currency and credit-creating purposes.

Before the War, and in its early stages, the foreign exchanges may be said to have truly reflected the value of gold as compared with our currency. This cannot be said today, when the ordinary commercial methods of settling our balance of trade have, more or less, been superseded by war measures, chiefly in the shape of loan operations. To illustrate this, a few figures are given. Expressed in the present New York exchange of 4.76, our currency shows a depreciation of 2%, whereas expressed in the Madrid exchange of 17.02 pesos our currency shows a depreciation of not less than 32%; on the Amsterdam exchange of 9.31, a depreciation of 23%; on the Stockholm exchange of 13.67, a depreciation of 25%; on the Copenhagen exchange of 15.31, a depreciation of 16%. It will at once be apparent that these exchanges cannot faithfully reflect the value of our currency. There can be little doubt that our adverse balance of trade with the United States today is far and away greater than that with countries such as Spain, Holland, or the Scandinavian countries. Nevertheless, the New York exchange is only 2% below par, whereas that of Spain is 32% below.

There can be little doubt that the artificiality of the exchange position will perforce have to continue for some time after the War, because it may turn out for a time to be more important to keep our currency reservoir adequately filled for the creation of credit for internal purposes than to settle our balance of trade by gold shipments.

A bounty based upon the exchange position, apart from not truly reflecting the value of gold, has another important drawback. It would be subject to violent fluctuations and to a great amount of uncertainty in regard to its duration. It would, therefore, have all the drawbacks attaching to a bounty too closely circumscribed as regards its duration and extent to which reference has been made previously, and would, therefore, not stimulate to any material extent the increased production of gold.

Few mine-owners, though they are usually speculatively inclined, will care to embark on any important capital expenditure on what would amount to a speculation in exchanges.

But the worst feature of a bounty based upon the exchange position is that it decreases in the same ratio as it proves its worth. In other words, the more the increased production of gold proves efficacious in restoring our exchanges to normal, the more is the increased production discouraged by the lowering of the bounty. If the increased production were needed merely to enable us to right the foreign exchange position, it would be right for the bounty to decrease as the exchanges improved. But the nation desires more gold not only to be able to settle its adverse net balance of trade with foreign countries, but to so fill its currency and credit reservoir as to enable credits to be built upon it which will be

adequate to meet the great requirements of our commerce and industry when we resume our peace occupations.

Those who object to the idea of a bounty because there is no precedent for it should recollect that this war is unprecedented, that the economic conditions created by it are unprecedented, and that already many things have happened on the economic field for which it will be difficult to find precedents. They should be reminded of the purchase by the Government of the Broken Hill zinc-concentrate, of the support given to the dye industry, the granting by the Government of bounties to producers of wheat, potatoes, etc., and of the differentiation in rates of interest allowed on money deposited by people in this country and by foreigners.

The question has been asked, why not, in order to do without the word 'bounty', raise the price of gold? The answer is that one of the most important attributes of gold is the fact that by common and tacit consent of the nations, its price is fixed. It is this attribute that fits it best to be a measure of value. If this idea were disturbed, gold would be robbed of one of its most valuable properties.

The raising of the price of gold would, moreover, lead to utter confusion and no doubt to a rise in prices of all commodities, with the end result that, as working costs would increase in the same proportion as the price of gold was raised, the mines would be in the same position they are in today.

Cost of Mining Supplies in Korea

The Oriental Consolidated Mining Co., an American corporation operating a large concession in Chosen, mined 303,672 tons of $5.90 gold ore during the year ended June 30, 1918, and reports the following increases in the cost of its supplies since 1914. The October output of this company was valued at $92,000. Previous monthly yields were as high as $140,000.

	Unit	Delivered 1914	Delivered 1917	Advance %	Delivered 1918	Advance over 1917 %
Nails	pound	$0.05	$0.07	40	$0.12	71
Cement	cask	5.00	6.80	36	7.50	10
Sheet-iron	pound	0.04	0.13	225	*0.13	..
Bar-iron	pound	0.03	0.07	133	*0.07	..
Drill-steel, ¾ hexagon	pound	0.08	0.14	75	0.16	14
Steel shafting	pound	0.06	0.16	167	*0.16	..
Picks	pound	0.13	0.15	15	*0.31	..
Hammers, No. 4	each	0.30	0.50	67	0.80	60
Hammers, No. 8	each	0.60	0.90	50	1.20	33
Shovels	each	0.63	0.90	43	*0.90	..
Rail, No. 12	pound	0.03	0.05	66	*0.05	..
Rail, No. 20	pound	0.04	0.06	50	0.07	17
Track spikes	pound	0.05	0.06	20	0.12	100
Car-wheels	2 wheels and axle	4.00	11.50	187	26.50	130
Wire-rope, 1-in. hoisting	foot	0.18	0.37	105	0.65	76
Battery shoes	pound	0.04	0.07	75	0.10	43
Battery dies	pound	0.04	0.07	75	0.12	71
Quicksilver	flask	43.50	126.00	190	*126.00	..
Vanner-belts, 6-ft. Frue	each	130.00	145.00	12	138.00	Decline
Battery-screen, 27-mesh punched	112 sheets	12.50	14.50	16	17.36	20
Pipe, 2-in.	length	3.00	5.50	83	7.00	27
Pipe, 4-in.	length	10.00	12.25	22	21.50	75
Pipe fittings	.....	....	....	75	....	..
Zinc-sheets	pound	0.09	0.30	233	0.25	Decline
Galvanized roof iron-sheets	each	0.60	1.20	100	....	..
Dynamite, 40%	50 lb.	8.00	15.00	87	*15.00	..
Dynamite, 60%	50 lb.	11.00	17.50	59	*17.50	..
Fuse	7,200	35.00	43.20	23	57.60	33
Detonators	10,000	40.00	150.00	275	*150.00	..
Cylinder oil	gallon	0.55	0.72	31	0.85	18
Engine oil	gallon	0.35	0.59	63	0.63	7
Lubricant (compound)	pound	0.10	0.10	..	0.12	20
Wire-rope 'dope'	pound	0.12	0.14	16	0.16	14
Kerosene (1914 first grade) (1917 third grade)	gallon	0.30	0.35	17	*0.35	..
Carbide	pound	....	0.07	..	*0.13	86
Candles	pound	0.08	0.16	100	*0.06	..
Waste	pound	0.06	0.12	100	0.08	Decline
Rope, Manila	pound	0.16	0.21	31	0.25	19
Rubber-covered copper wire, No. 2	foot	0.07	0.12	71	*0.12	..
Weatherproof copper wire, No. 4	pound	0.26	0.40	54	*0.40	..
Belting, balata, 6-in	foot	0.50	1.00	100	*1.00	..
Lumber, native	.....	....	no change	...	....	30
Cordwood, native	.....	....	no change	...	....	25
Timber, native	.....	....	no change	...	....	30
Cyanide (KCN in 1914, NaCN in 1917)	pound	0.18	0.29	61	0.35	20
Borax	pound	0.06	0.12	100	*0.12	..
Litharge	pound	0.08	0.16	100	0.18	12
Bicarbonate of soda	pound	0.03	0.05	66	0.06	20
Manganese di-oxide	pound	0.04	0.14	250	*0.14	..
Flour, American	50 lb.	1.80	6.00	233	4.75	Decline
Carnation cream	case	5.67	7.70	36	8.88	15
Sugar, moist	134 lb.	7.50	9.00	20	14.63	63
Lard	pound	0.12	0.35	191	0.45	20
Bacon	pound	0.37	0.65	75	0.80	23
Canned vegetables	.....	....	....	67	*....	..
Canned fruits	can	....	0.55	40	0.80	45
Lime, native	1000 lb.	6.00	5.00	17 decline	5.00	..

*Delivered on old contract or none bought.

Labor's Share

BY AN OCCASIONAL CORRESPONDENT

Of all the problems looming large above the horizon of post-war reconstruction, the greatest of all is Labor, labor with a capital L. Without going too extensively into the dominating position attained by organized labor during the period of the War, it is no exaggeration to state that the mailed fist with one blow has been amputated from the arms of kings and kinglets and grafted upon the persons of the labor leaders.

The vast power wielded by them is exercised in different ways in different countries, with practically the same result in each case. Russia is in a state of pitiful chaos through the ascendency of the Bolsheviki, the radicals of radicals. In Germany, the Spartacus group which corresponds in principle with the Russian Bolsheviki, is struggling with the less irresponsible Socialists. In our own country, the Industrial Workers of the World, the American Bolsheviki, have become the representatives of the malcontents and failures, who, apparently would wreck the whole industrial fabric of the Nation, from which, in some miraculous way, another nation is to rise in fullfilment of a Utopian dream of no work and high pay.

The Union labor leaders are as bitterly opposed to the I. W. W. as the capitalists, and have steadfastly refused to espouse any of their doctrines. They seem content to take advantage of any opportunity to send wages kiting skyward, and work-periods sliding downward, apparently without thought for the morrow, when war-buying without regard to price will cease, and competitive conditions will again force a scrutiny of cost-sheets.

The fundamental difference between military and civil construction lies in the fact that with the former, time is the paramount consideration; with the latter, cost. During the War, the first consideration was fulfilled with signal success. The feats of the shipyards were chronicled daily; astounding numbers of rivets were driven by specially selected crews; hulls were launched in days instead of months, and people subscribed for Liberty Bonds in terms of billions of dollars, in order that the bill might be paid.

Contrary to the general impression, these remarkable speed-records were not accomplished as much by any speeding-up process on the part of individual workmen, as by multiplying the number of workmen and machine-tools many times over. A one-man job became a four or five-man job, and so on. Countless men from occupations remote from shipbuilding or munition manufacture left their barber-chairs or soda-water fountains, and, camouflaged as riveters, rushed to the shipyards for their dollar an hour, and double pay for over-time. If the high wage-rate was not enough, the famous 'work-or-fight' order of the Provost Marshal General provided the additional incentive. The exodus was general. And, now what?

War orders are being cancelled right and left. Instructions have gone forth to the shipyards stopping over-time with its double pay. Three million American soldiers and sailors will soon be demobilized, and drift back in search of their former occupations. Mr. Gompers has served notice upon the Bourbons that any attempt to secure a return to the wages and time-scales prevailing before the War would be fought by all the powers of resistance possessed by organized labor. 'To have and to hold' is the program.

There is one little detail that seems to have been overlooked in the desire to have Labor's four fat years continue indefinitely, and that is, before a mechanic can be given his five, six, or eight dollars for putting in eight hours at a shipyard, someone must sell his output for that day not merely for five, six, or eight dollars, but for enough in addition to pay for the material he uses, the overhead charges, and a return on capital besides, and do this in competition with the whole world. This is the point that is knotting the brow and graying the hair of the business-man and factory-owner.

Americans, in the past, have been the pampered people of the world. Blessed with every conceivable natural resource within their own borders, nothing was easier than to tackle their development, and let the outside world go hang. Foreign competition from the so-called 'pauper' labor of Europe was shut out by a sizable tariff-wall, behind which everybody grew and throve amazingly. Factory extensions were made to keep pace with development and a nice industrial balance was preserved. Scant attention was paid to foreign markets. We were too busy at home to bother, so Germany gobbled the South American business, Japan the Orient, England and France the remainder.

Then came the War. Factory capacities were doubled, trebled, and even quintupled, while new plants sprang up in a night. Mark Sullivan, editor of 'Collier's', says that our shipbuilding plant now has a capacity many times that of England. Who will buy the output of this great industrial equipment at prices based upon our present wage-scale, and an artificially limited output per workman?

A factory near-by retained the services of an efficiency engineer. In one of his tours of inspection, he noticed a certain forging in which it was the custom to drill the rivet-holes in place with pneumatic drills. It was a slow and expensive job. Accordingly, he made drilling templates, erected a radial drill-press in a convenient corner of the shop, and cut the time for drilling nearly 75%. A few days after inaugurating this reform, to his astonish-

ment he found that the drilling crew had returned to the old method. With fire in his eye, he tackled the foreman, and elicited this answer, "To hell with this efficiency stuff; we'll do as we please." The efficiency engineer has resigned.

Whether we like it or not, the workman has been taught to give as little as possible for as much as he can get. Through the policy of limiting the number of apprentices, opportunity to learn a useful trade is denied many of our young men. A workman who speeds up his work is made to feel morally and physically that to persist in such a course will, to say the least, be inadvisable. Expensive machine-tools and labor-saving devices are in operation a disappointingly short proportion of the working-day. Any pretext to shut-down is resorted to, in order to make the job last as long as possible. Groups of idle men are conspicuous around the yards, engaged in conversation and exchanging amenities remote from the conduct of the job in hand. Discipline is disregarded.

A group of laborers, working at an excavation for the foundations for a new shipyard, were the object of the scrutiny of a foreman, who watched in silence the homeopathic doses of dirt that soiled the business end of the shovels, until he could stand it no longer. Waxing sarcastic, he said, "Would you mind putting a little more zip into that shoveling?" The entire group threw down their shovels and quit. One of the men said, "We don't allow nobody to talk to us like that."

When there were two or three jobs for every available man, and at wages in proportion to the law of supply and demand, it was quite a fad to work three or four days for one employer, then quit, loaf the rest of the week, and then get another job elsewhere. Why not? Why kill oneself working when enough to live on can be made by working half-time? But, watch what happens when the whistle blows for quitting time. Instantly the crew becomes electrified into action; in other words, all hands 'beat it', while the going is good, and hundreds of impromptu Marathons are staged between the yard and the great gates which vomit forth the toiler. It is an interesting, instructive, and, in a way, a mournful spectacle.

Of course, it is easy to express an opinion, in terse language, on this kind of spirit, and to jump at the conclusion that it is typical of all workmen; but it doesn't do an atom of good, and only serves to widen the breach between employee and employer. There can be no denial that labor and capital, employee and employer, are drifting farther apart all the time; the problem is to find a remedy whereby the industrial fabric of the nation may be saved from the rocks toward which it seems to be drifting.

Charles M. Schwab said a few months ago that, from now on, the workmen would run the world. He qualified this remark later by explaining that he meant workmen in a broad sense, and not necessarily union workmen. Mr. Schwab has demonstrated his ability and breadth of vision many times, and it will be well for both employers and employees to heed his words and provide ways and means of meeting the situation. Little by little employers have tried many more or less half-hearted measures for meeting the demands of labor, but these measures, bonuses, piece-work, and the like, were merely stop-gaps, and have failed to satisfy the desires of the men.

The objection raised by workmen to piece-work, is that the high record of today is often made the mean basis for tomorrow's wage computation, and that the workman is driven to death by constantly increasing exactions on the part of the employer. The giving of a bonus conveys the impression of a gratuity, a charity on the part of the employer, an act of patronage from master to man, which does not sit well on the independent character of the American workmen. Back of it all lies the fact that the workman is a rank outsider. The inner affairs in the administration of the business are barred from him; he is not informed on the multifarious administrative, financial, and sales problems. When work is slack, he is 'laid off' without ceremony. When work is plentiful, he is hired in droves, not as an individual but as a commodity; in short, not one blessed thing is done for the development of morale among the workmen, nothing to differentiate between him and the cattle in the field. The larger the establishment, the more acute this shutting-out process becomes. He looks with suspicion, not to say disbelief, upon any pronunciamento issuing from employers or associations of employers. Stories of losses on contracts, inability to meet increased wage exactions and avoid bankruptcy, and similar wails of anguish are laughed to scorn. First it was a 10-hour work-day, then a nine, an eight, now a 44-hour week, while the I. W. W. talked about a 6-hour day before they were unceremoniously rounded up and deported by the mine-owners at Bisbee. The whole system is unreasoning, unscientific, and in the end destructive of industry.

There is a remedy somewhere; suppose, for instance, that in attempting to solve the problem, one were to start with the two elements, labor and capital, and attempt their fusion into a homogeneous union for their mutual well-being. It is admitted that each is entitled to compensation that will be fair to both: for capital a rate of interest return that will reasonably represent the character of the investment; for labor, a wage that will afford a reasonable surplus over and above the cost of living to provide in modest measure the comforts and pleasure without which life is a dreary drudgery. So far, so good. Now for the meat of the whole thing.

Effect a series of organizations within the parent organization, making each department an organization within itself. These internal organizations may be divided into a suitable number of shares without par value, but permitting each share to participate in the profits of that department in proportion to the number of shares issued. These profit-sharing shares are to be the property of the workman during the period of his employment only, and are to revert to the organization for reissue in the event of his leaving his employment for any reason.

A Board of Direction is to be formed composed of one

representative from each department selected by the workmen of that department. This Board is to meet at regular intervals for the consideration and discussion of all matters of business, external and internal, effecting the welfare of the business. It is essential that the workmen shall be taken into full confidence. In no other way can they be made to feel that they actually are an integral part of the business, sharing with the management the full responsibilty for its success or failure.

Cost-keeping has become a science. Detailed estimates are always prepared showing the extent of the participation and estimated cost of the work done by each department in the execution of every contract. Thus the estimated profit is known, and can be allotted in proportion to the work done by and to each department. When the job is finished, reports can be submitted to the Board showing which department has failed to earn its quota, and which has done better than its quota. The actual profit earned by each department on each job can be assigned to it for dividend purposes after the wage to labor and the interest to capital have been paid. Surplus earnings over labor's wage and capital's interest can be split equally between the workman and the company stockholders.

In this way, only those who earn will participate in the profits. The dividends to workmen, according to this scheme, will not be distributed indiscriminately, but will go only to the department that has earned them. The delegates from the shops to the Board of Direction will be in full possession of all the facts, figures, and statistics at all times. They, as representatives of the workmen, will act for them, keep them in possession of all facts concerning the conduct of the business, in short, will prevent their being hocus-pocused through juggling of figures, or any other form of dishonesty.

Shop discipline will be largely in the hands of the men themselves. The shop representative on the Board will have a voice in designating the men to be laid off in slack times. The men, feeling a direct personal interest in the success of the enterprise, owing their sharing directly in the profits of their own labor, may be trusted to select their own foremen, who would, preferably at the same time, be their delegate to the Board of Direction. Inter-shop disputes and delays in transmittal of material from one department to the other would be under the supervision of the superintendent or manager. Liaison in factory administration, as in the operation of various sections of an army, is essential.

In the working out of this scheme, capital gets a little the worse of it. When times are bad, and work is slack, capital gets nothing, while the workman still gets his wage. This, however, is inevitable, as a living wage is essential to the workman, while capital generally represents the combined surplus of many people, and outside the widows and orphans of whom stock inflators are so fond of talking, most capitalists manage to eke out a precarious livelihood no matter how hard the times, or how scarce the dividends.

In general, what has been attempted to outline in a sketchy way here is merely the skeleton of an idea of making labor and capital one instead of two. The long-haired phrase-maker who descants upon the iniquity of capital and the glory of labor probably never did a square day's work in his collective life. The politician who panders to all that is bad in trade-unionism for the sake of votes is even worse. Labor itself should give a thought to the morrow, as should the capitalist, the factory-owner, and the business-man. This scheme is not offered as a substitute for trade-unionism, but is a plan to make a self-respecting citizen of the workman, a citizen who will share the responsibilities of life with his fellow-man, a man to whom sabotage will be abhorrent, who will participate in fair proportion in the profits of his own labor, who by this means can see not merely a decent living as his portion but an opportunity for the accumulation of a reasonable surplus against the day when old age shall overtake him, and he will be unable to work any longer.

The walking delegate won't like this scheme, however, He will have no choice but to go to work. The socialist will be out of a job, until he can devise a plan to give the workman all the profits and the capitalist none at all. Anyway, the goose that has been laying all the golden eggs during the last four years is nearly played out. Prices are coming down. Competitive conditions are returning. The product of our factories, increased many fold in volume, will soon have to be sold at prices that will compete with those of other nations.

A lot of eminent gentlemen are about to sit around a table at Versailles. Why not start a little peace-table of your own, and see if you can't do something to ward off a smash?

Electrolytic Zinc in Australia

The Electrolytic Company of Australia, operating in Tasmania, has the first unit of its plant running continuously. Over 90 tons of high-grade zinc is being produced weekly. Results have proved definitely that the project is a commercial one and thoroughly sound. Plans for a larger scheme, embracing the treatment of approximately 250 tons of zinc concentrate per day, to yield 100 tons of electrolytic metal, are now under consideration. At the request of the hydro-electric department of the Government of Tasmania, the company has indicated its willingness to take a second block of 26,000 hp. in two sections of 11,000 and 15,000 hp., respectively. The hydro-electric department states that the first block of 11,0000 hp. will be available in about 18 months, and the remainder of 15,000 hp. at a later date. Investigations have proceeded further and with satisfactory results in regard to the establishment of several allied industries. Some of these will involve the allocation of the third block of power. Amalgamated Zinc (De Bavay's), of Broken Hill, controls this company. During its last financial half-year, the flotation of 164,719 tons of old tailing recovered 47,184 tons of concentrate assaying 48.2% zinc, 6.4% lead, and 9.1 oz. silver per ton.

REVIEW OF MINING

MONTERREY, MEXICO

Review of the Railroad Situation in the Republic.

Renewal of revolutionary disturbances has caused another suspension of operations of several divisions of the National Railways of Mexico. The trouble is confined chiefly to the States of Chihuahua and Durango. No through trains are running between El Paso and Torreon. Interruptions of traffic on the line between Eagle Pass to Torreon are also reported. Tranquility prevails along the route of the main line of the National Railways all the way between Laredo and the City of Mexico, as well as in the territory traversed by the Monterrey-Matamoros, the Monterrey-Torreon, and the Saltillo-Torreon divisions. Through sleeping-car service is maintained between Laredo and the City of Mexico. Mining and other industrial conditions in the State of Chihuahua continue to be seriously affected by the depredations of roving bands of revolutionists, all claiming to be a part of the so-called army of Francisco Villa. During the past few weeks Villa has been making desperate efforts to reach some border point. It is said that he has in his possession an enormous store of silver bullion which he 'confiscated' from various mines within the scope of his operations. He is anxious to dispose of the precious metal to agents on the American side of the Rio Grande, and he cannot well do this unless he obtains control of a 'port of entry.' His border objective is believed to be Ojinaga, situated opposite Presidio, Texas. According to current report in mining circles, the value of the bullion that Villa is now carrying about is more than one-half million dollars. One of the reasons that he is so anxious to turn it into money as soon as possible is that his wife, who is living in San Antonio, is in almost destitute condition. Villa wants to provide her with funds to relieve her from her distress.

In the Pacific coast region of Mexico, along the line of the Southern Pacific, business and industrial conditions show a big revival. Much attention is being given to the construction of large systems of irrigation in the valleys of the Fuerte, Sinaloa, Mayo, and various other rivers. The coastal belt for 600 miles bordering the Pacific is splendidly watered with running streams, which afford ample supply for irrigating many million acres of land. Sugar-cane is already extensively grown, and it is planned by some of the larger planters to grow cotton on a considerable scale. Upon the slopes of the mountains running down to the coastal country some coffee is raised. In one part of Durango, more than 100 miles from the nearest railroad, wild coffee is found in great abundance. The berries are small, but the flavor is said to be delicious. The bushes cover the mountain-sides in great profusion, and their annual crop of coffee is the source of supply for thousands of natives.

It was not until the Southern Pacific Railroad of Mexico

was constructed down the coast from Guaymas that a transportation outlet for the rich agricultural and mineral region was obtained. When the Madero revolution was begun in the late fall of 1910, the railroad had reached the picturesque tropical town of Tepic, about 800 miles southeast of Guaymas. Grading was in progress on the division that was to run between Tepic and Orendain, the latter point being 25 miles west of Guadalajara. This construction work was stopped, and has not as yet been resumed. It was the original plan for the coast line of the Southern Pacific to run all the way from Guaymas to Salina Cruz, where it would have connected with the National Tehauntepec railroad. From Tepic to Salina Cruz is 1100 miles. That part of Western Mexico is as yet wholly lacking in railroads. It is a region of vast undeveloped riches. But for the revolutionary troubles it is believed that the Southern Pacific would have added by now more than 1500 miles to its railroad system in Mexico. Even during the long period of vicisitudes that it has gone through, its intermittent operation has brought great industrial benefit to the ports and towns along its route. The line crosses the Kansas City, Mexico & Orient's Pacific division at San Blas, and is thus given access to the port of Topolobampo. In this connection it is interesting to mention that Topolobampo is chiefly noted for being the site of an American colony of socialists that was established there more than 30 years ago. They prospered for a time, but in a few years it lost its identity as a colony. Descendants of some of the original settlers are still living there. Altata and Mazatlan are two other Pacific ports that are given rail outlets by means of the Southern Pacific. If the line should be extended to Salina Cruz it would touch at Acapulco, which has long been one of the principal but most isolated ports on the West coast of Mexico. During the administration of the late president Porfirio Diaz, the port and harbor of Salina Cruz were improved at a cost of several million dollars. In the days before the Panama Canal it was a busy place, being the Pacific terminus of the National Tehauntepec railroad. It has fallen into a neglected state that calls for repairs in order to make it properly serviceable.

One of the significant features of the railroad situation in Mexico so far as improvements being made to existing lines or the construction of new roads by the Government is concerned, is that nothing of this kind can be done without foreign financial assistance. This help must come from the United States. From time to time during the past year, semi-official reports have been issued from the City of Mexico that the Carranza government was preparing to commence extensive railroad building and repairing of existing lines. Practically no work of this kind has as yet been done, for the simple reason that money for the purpose has not been obtainable. It is deemed probable that if the Mexican government shows the right sort of attitude and encouragement to American investors several railroad projects, the urgency of which is quite apparent, will be carried out in the near future. One of these proposed lines is to run from Tampico north along the Gulf coast to Matamoros, opposite Brownsville, Texas, a distance of about 325 miles. The route is through one of the richest and most undeveloped parts of Mexico. Besides the oil potentialities of the region, it is capable of producing a great variety of crops. Direct rail connection of Tampico with the City of Mexico is also proposed. This road was started several years ago and more than 100 miles of the grade was constructed.

The Nacozari Consolidated company is reported to have acquired the Tharis York copper property adjoining. The new owner operates a silver-lead mine. Its main adit is in 2500 ft. and can now be extended through the Tharis.

Greene-Cananea produced 5,100,000 lb. of copper and 169,560 oz. of silver during November. This is the largest output for 1918, and 800,000 lb. above October.

LEAD, SOUTH DAKOTA

New Work in the Black Hills Region.

Lead.—In order to conserve power, the Homestake company has purchased two Ingersoll-Rand direct-connected electrically-driven compressors. They will each have a capacity of 4500 cu. ft. of air per minute. One is being erected at the B and M shaft; the other at the Ellison shaft. The large compressor now in use at the Ellison has a capacity of 7500 cu. ft. This, together with compressors now in use, gives a capacity not needed at all times, and the additions are being made to conserve power. The Brig and Golden Gate hoists are now electrically operated.

The labor situation has been relieved, and it is expected that the stamps in the Golden Star mill will be dropping again soon after January 1.

The Mineral Point mill is still out of commission, but it is expected that this plant will be at work early in the new year.

Hill City.—The American Tin & Tungsten Co. continues work at both the Mohawk and Cowboy mines. At the former, sinking is in progress; at the Cowboy ore is being broken on the 300-ft. level. A good deal of ore has been broken, and this will be hoisted and delivered to the mill as soon as the plant is ready. A 60-hp. hoist is being erected at the Cowboy to handle a one-ton skip. The ore will be hauled from the mine to rail by an Acme five-ton truck and delivered to the mill-bins in railroad cars. Before working the plant on tin ore, the following new equipment will be added: Telsmith gyratory crusher, Hardinge ball-mill, three Richards pulsator classifiers, Deister plato slime-table, and an electric-furnace for smelting concentrate. It is expected to have the new installations completed by March 1, when the plant will resume dressing tin ore. A saving of both cassiterite and mica will be made. Ralph A. Meyers is manager.

The shaft at the First National has been unwatered and the mine is being examined by engineers from Michigan. The property is equipped with a 10-stamp mill, and it is proposed that work will be resumed early in 1919.

Regular shipments of copper are being made by the Maloney Blue Lead Co., near Sheridan. A boiler and compressor have been put in.

Keystone.—A. T. Roos and associates have leased the Bob Ingersoll mine, and are making regular shipments of columbite-tantalite to the Eastern market. Amblygonite is also being extracted. This will be shipped as soon as a market is found.

Custer.—The Rare Minerals Co. is hurrying construction of its concentrator, expected to be ready early in 1919. Tin ore is being mined at the Hebert mine near Oroville, and this will be shipped to the mill for treatment. In addition, ore will be taken from properties in the vicinity of Custer.

The Old Mike mica mine near Berne, which has been making regular shipments, has been sold to Idaho people who are making arrangements to continue work. The new owners will organize under the name of the Berne Mica Corporation, and will enlarge operations.

The concentrator of the Spokane Lead & Silver Co. continues to produce lead-silver concentrate. This is hauled to rail at Keystone in trucks and shipped to smelters.

Ardmore.—The Refinite company has temporarily suspended work awaiting arrival of a new dryer of special design. It will increase the output of the product, which is used in softening water. The plant has proved a success and there is a demand for the product. The impure kaolin is dried, crushed, and pressed, followed by drying in steam-heated chambers and direct flame-dryer. After this is completed the product is ready for specially-designed filters, in which it is used to remove the hard properties of water.

PLATTEVILLE, WISCONSIN

Zinc, Lead, and Pyrite Conditions in November.

Unsettled conditions in the market for second-grade zinc ores during the latter half of November, coupled with serious inroads by influenza, aided materially to reduce output of the various fields. The end of the War contributed not a little to disorganize working forces from the 7th to the 15th. Thanksgiving was taken advantage of more liberally this year for time off than in former years, and operators were none too diligent in refusing this, as markets at about that time slumped decidedly and smaller outputs were welcomed. Labor conditions showed some improvement toward the end of the month, especially in the southern parts of the field, where forces were restored sufficiently to renew unbroken shifts. Men began returning from the camps, and labor-gangs from the large commercial centres began to trickle in. War-time prices for zinc ore, leading operators agreed, could no longer be expected, but it was argued that the end of the War should mean quickly lowered costs for powder, steel, and supplies. The high cost of living, it was pointed out, made it impossible to even suggest a reduction in wages, and a demand for reduction in the price of supplies it is believed will become insistent or else a curtailed output, and reduced working forces will be the plan operators will be compelled to pursue. Little reserve ore was used up in November, and close estimates made at the end of the month accounted for 7500 tons of zinc concentrate of all grades in bin.

High-grade refinery ore for sheet makers fared better. Lead ore prices held up well, sales totaling 1000 tons. A fair reserve was carried over into December. Shipments of pyrite were light. The two Government sulphuric-acid works being erected were shut-down. Deliveries totaled 14,269 tons of zinc ore, 976 tons of lead, and 1299 tons of pyrite.

VICTORIA, BRITISH COLUMBIA

General Mining News of the Province.

It is interesting to trace, by means of the records of applications for leases on the different placer grounds of British Columbia, the effect of the market demand and general conditions during the last several years. In 1915, prices had not risen to the height that they reached later during the War, and the labor problem was not as serious, with the result that the mining of the placer areas of the Province proceeded much as usual, about 160 leases being issued during twelve months. In 1916, with base metals, etc., at high prices, dearth of labor, and high costs, the number of applications for placers were reduced to 87. But in 1917, although the same conditions obtained, the demand and high price for platinum, which is found in many of the placers, once more fired the enthusiasm of prospectors and others, resulting in the issuance by the Department of Mines of 139 leases. The total for 1918 will show that the interest was maintained, as it will reach approximately 137 leases. Of the latter, 35 bench leases and 9 dredging leases were granted during October and November.

Hazelton.—A car of molybdenite was shipped from the Hazelton View mine during the past winter. Two tunnels are being driven, development to continue during the next few months.

Dalby B. Morkill, mine superintendent of the New Hazelton Gold Cobalt Co., a Vancouver corporation owning a group of claims on Rocher de Boule mountain, is satisfied with results of development. Two tunnels are being driven. One of these is on the Victoria gold-cobalt-molybdenum vein at a point 1100 ft. vertically below the apex, and 350 ft. below the main tunnel.

Vancouver.—A depth of 625 ft. has been reached by the drill that is being put down for oil in the Burnaby district near here by the Spartan Oil Co. Indications are said to be promising, and oil is expected to be struck at 1000 feet.

Princeton.—After an inspection of the Copper Mountain plant of the Canada Copper Corporation, G. O. Bradley, of Bradley, Bruff & Labarthe, has returned to San Francisco. He reports that satisfactory progress is being made in erecting the 2000-ton plant. The 100-mile power-line of the West Kootenay Power & Light Co. probably will be completed to the property some time next summer.

Rossland.—Ernest Levy, general manager of Le Roi No. 2 (Josie), states that the mine produced in the year ended September 30 last, 19,000 tons of ore.

Phoenix.—That the Phoenix mines should be prospected by diamond-drill with a view to proving the existence of ore for operation of the now idle Greenwood smelter is a suggestion made by residents of the district. It is said that the Provincial government is to be asked to extend financial aid to permit starting of this work. The Hon. J. D. MacLean, Provincial secretary and member of Parliament for Greenwood, and J. E. Thompson, member for Grand Forks, are said to be in sympathy with the proposal, and are ready to render support. Through Oscar Lachmund, former general manager for the Canada Copper Corporation, commercial interests of Greenwood determined that the smelter shall not remain inactive, have asked the company to lease the plant for $10,000 per year in order that the citizens' company may operate it. The company's directors at New York are said to have these and other suggestions under consideration.

Prince Rupert.—With the revival of mining in the Portland Canal district this town has commenced an agitation for the local establishment of a smelter, to enable many contiguous properties to be operated.

Barkerville.—Discussing the season's operations in the Cariboo district, Henry Boursin, a well known mining man, makes the following statements: "The output from the hydraulic mines this year was less than that of last owing to a shorter water season and scarcity of labor... The clean-up of the Stout's Gulch mine was more than usual, due to the discovery of another channel of pay-gravel. Stout's gulch is a small stream just above Barkerville. The yield of gold from the gulch, first by driving and later by hydraulic, amounts to $2,500,000. The width of hydraulic pay, more than 600 ft., is extraordinary for such a small stream.——C. W. Moore, acting for American capital, has bought the locally-owned Waverly hydraulic mine on Grouse creek, four miles from Barkerville. Although the Waverly is one of the oldest hydraulic properties in the Province, it doubtless contains more gold than has been washed out of it, as the head of the sluice-flume is 30 ft. above the bottom of the pay-gravel in the main channel, and the gravel below the flume is known to be rich.——F. J. Tregillus, T. A. Blair, and Pat Carey are sinking a shaft on the 9-ft. gold-bearing vein in their Warspite claim four miles from Barkerville. At the present depth, 14 ft., the shaft discloses an excellent showing of visible gold, while the rock in which no gold can be seen shows a nice string of flour-gold when mortared and panned. The vein on which this work is being done has been exposed at intervals by trenching and open-cuts a length of more than 8000 ft., and is believed to be the 'mother lode' from which the $20,000,000 placer of Williams creek and the $2,500,000 placer of Grouse creek have their origin. The creeks mentioned drain the western and eastern slopes respectively of Proserpine mountain, and the strike of the vein closely approximates the up-stream limit of rich placer on each creek.——The Lightning Creek Gold Gravels Co. is drilling with a Keystone on Lightning at Wingdam. This company was promoted by C. H. Unverzagt of New York, and last summer an agent of the United States government was sent to the property to see how conditions tallied with advertisements."

ARIZONA

Jerome.—United Verde Extension pays 75c. per share on February 1. This amounts to $787,500.

The Shea Copper Co. has made its first shipment of ore to the United Verde Extension smelter. The ore contained over 9% copper, besides gold, silver, and an appreciable amount of antimony. The ore is coming chiefly from the 325-ft. level.

Kingman.—The Leviathan mine and mill, a molybdenite producer, have suspended operation for the time. This company ships its concentrate to Los Angeles for treatment.

The Walkover mine is being unwatered.

The Emerald Isle Copper Company recently made a shipment of 4500 lb. of cathode copper to San Francisco. This electrolytic plant is now turning out 2500 lb. daily. Carload shipments will be made hereafter. Preparations for opening a glory-hole are under way, and present work indicates 200,000 tons of 3% ore.

Ray.—Considerable mixed litigation has been started over the Ray silver-lead mines, three miles from Ray, a property mainly owned in Tucson, under lease to C. E. Addams, former manager of the Ray Hercules mine. The lease is said to have been clearing $15,000 per month, divided equally between Addams and the company, which before the leasing period is said to have made little profit. The ore has to be packed on mules to Ray, for rail shipment to El Paso. Locally there is a suit by W. W. Lawhon, a mining broker, who asks a share in the contract alleged to have been made for the lease by Jim Pollard, former superintendent of the property, with whom he alleges he was a partner. Pollard assumed to have some share in the profits of the lease, other than those that come to him as a stockholder in the corporation. Another suit is that filed in New York by F. C. Armstrong, president of the Ray Hercules company, who alleges that Addams secured the lease at a time when he was in Armstrong's employ and when all his services and the profits therefrom were Armstrong's due.

Superior.—Magma Copper pays 50c. per share, equal to $120,000, on January 6.

Tucson.—It has been announced by the south-western representative of the American Smelting & Refining Co., in answer to recent rumors, that it is impossible to state at present whether the Sasco smelter at Silverbell will continue operations or not. Only one furnace is in blast at present, it being impossible to get more ore. The mine at Silverbell is producing 9000 tons per month. It is too low grade to stand shipment to Hayden in the event of the smelter being closed.

In the recent decision of the Superior Court, the Stratton claims in the Old Hat district, held by the receiver of the Stratton Copper Co., reverted to Stratton, the owner. The Daily Arizona Consolidated Copper Co. immediately exercised its option and purchased three of the claims. Other claims are to be sold to the Wilson interests. The Daily Arizona has let a contract for development to Copeland brothers.

Walker.—The Black Diamond Mining & Development Co. has completed erection of an Ingersoll-Rand compressor with jack-hammers. The manager, C. N. Brown, states that everything is running smoothly and a mill is contemplated soon. Sinking continues at 250 ft. depth.

The Homestead mine was closed for a week awaiting engine parts. The manager, John Harlan, reports resumption of mining in a breast of hard rock encountered in north cross-cut.

The North Capital claim, owned by J. I. Gardner of Prescott, has been bonded to Crank, Ashton, and Comer, who are opening a cross-vein. Shipping ore was cut at 40 ft., principally lead bearing.

Johnson & Strom, lessees at the Eureka, shipped a car to Humboldt netting $55 per ton.

J. Hayes has bonded the Hidden Treasure claim and will start extending an old tunnel. Regular shipments of pyrite for fluxing will be made to Humboldt. The ore also contains gold and silver.

CALIFORNIA

Press dispatches from Washington on December 18 state that Van H. Manning, director of the U. S. Bureau of Mines, on the solicitation of Representative Kahn, has agreed to recommend to Congress the establishment of a mine-rescue station in California. The new station will be either at San Francisco, Berkeley, or some other suitable point. An annual appropriation of $17,600 will be necessary.

Bulletin 161, Law Serial 13, by J. W. Thompson of the U. S. Bureau of Mines, Washington, D. C., contains all Californian mining laws, with amendments. Included are actions relating to mining claims, eminent domain, employer's liability act, hours of labor, miners' licenses, liens, and wages, mineral lands and mines, State Mining Bureau, mining corporations, mining debris, oil and gas, taxation, water-rights, and explosives.

Hammonton.—Yuba Consolidated, during the year ended February 28, 1918, according to the annual report of the Consolidated Gold Fields of South Africa, just issued, recovered gold worth $2,849,220. This is equal to 18.42c. per cu. yd. on 15,468,000 yards dredged. Expenses were $758,529, equal to 4.90c., leaving a profit of $2,090,691, or 13.52c. per yard. In the four months—March to June, inclusive—the average yield was 18.3c., expenses 6.68c., and net operating profit $584,351.

Igo.—The Crystal mine, a silver property near Igo, has been re-opened by A. N. Kingsbury, who already has made a carload shipment to the smelter at Kennett. The mine was shut-down some years ago. It was once sold for $25,000, but it has been closed for 30 years. Kingsbury is satisfied he can make the mine pay. This is the only silver mine in Shasta, and one of the few in the State.

COLORADO

Breckenridge.—The French Gulch company completed its dredging season at the end of November. The final shipment of gold was worth $20,000. The 3-cu. ft. boat is now being overhauled, ready to commence in the spring. W. F. Sears is in charge.

IDAHO

Adair.—The Richmond M. M. & R. Co.'s smelter returns for November were $13,299. Operations cost $4000, plus

$1000 for the annual State tax on net earnings. Ore carries 6 to 7% copper. Development is generally satisfactory. B. N. Sharp is manager.

Boise.—According to Robert N. Bell, State inspector of mines, the Idaho mineral output during 1918 will show a decrease of 20% when compared with 1917. In the Coeur d'Alene, which contributes 90% of the State's production, there has been a great shortage of labor. But this should soon be rectified by the release of men by the Government. In central Idaho is a vast mineralized area practically untouched, due to its isolation. Road construction is necessary for this region.

Kellogg.—Bunker Hill & Sullivan distributed $4.75 per share during 1918. This is equal to $1,553,250, and makes $22,086,750 to date.

Caledonia Mining Co. will pay 1c. per share, equal to $26,050, on January 6. Previous distributions were 3c. per share. The total now is $3,699,100.

Mullan.—The Idaho-Carbonate mine has been closed until spring on account of the labor situation. During the past year the 2-compartment shaft was sunk 440 ft. from the tunnel-level. The mineralized zone on the 400-ft. level is to be prospected.

The Copper King M. & S. Co. is to be financed by selling 500,000 shares at 10c. each. This would realize $50,000, half to be spent on a 50-ton mill and half on development.

Porthill.—According to A. Klockman, general manager of the Idaho-Continental mine, ore-reserves above No. 4 tunnel are now 250,000 tons, compared with 144,000 tons in July 1917. There shoots have been followed for a total of 1800 ft. Awaiting shipment is 1600 tons of $100 lead-silver concentrate. The water-supply is being improved. About 200 men are employed, the only shortage being machinemen.

Wallace.—At a depth of 1000 ft. in the Amazon-Manhattan the orebody has been followed for 1100 ft. Two levels above have also opened the same vein. The ore carries zinc and lead, also silver.

MICHIGAN

Houghton.—Every mine in the copper country, excepting two, has all the trammers than can be employed. The labor situation has not changed so quickly that the mines are filled again, but the influx of common labor to the Lake Superior district has been rapid in the past six months. The great need for trammers has been filled. For a year past there was no difficulty at any of the mines in securing all of the skilled laborers that were needed, but trammers were always wanted. Wages paid for trammers and the contracts made for rock haulage were so high that many miners started tramming because they could make more money at it. A limited number of miners could be utilized at most of the mines, and this would mean the employment of additional trammers. Production of ore has by no means reached the total that might be justified from these properties if the labor situation could be arranged with entire satisfaction to all, but the change for the better is pronounced and constantly improving.

Calumet & Hecla and subsidiaries produced 10,499,711 lb. of copper during November. This is 1,500,000 lb. less than in October. C. & H. accounts for half of the total.

MISSOURI

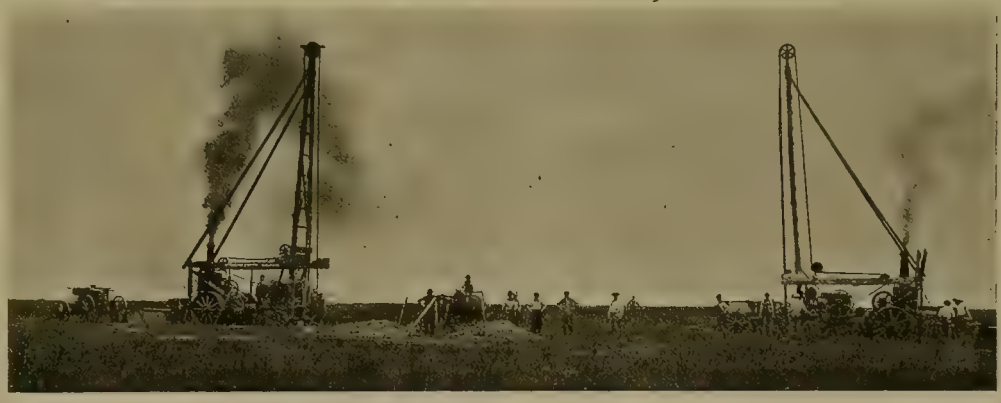
Joplin.—Production of the Tri-State region last week was as under:

	Blende, tons	Calamine, tons	Lead, tons	Value
Kansas	42	..	98	$2,524
Missouri	477	38	85	36,154
Oklahoma	3,775	..	803	234,116

Average prices were $45, $38, and $79 per ton, respectively. The demand was good.

According to E. Z. Eberlein, manager for the Constitutional Lead & Zinc Co., the time was never more auspicious for drill development. He did not mean the development of wild-cat properties, but the blocking-out of proved mines. Just now there is no excuse for heavy production. A good many mines are going to be closed-down entirely, and while they are the managements should, he considered, proceed to block-out their properties carefully and find out just what they have. It is something they doubtless will do sooner or later, and it would be much better to do this now while other operations are quiet.

According to Charles McDonald, speaking to the Joplin 'Globe', "they will all be coming back to this camp [Joplin] to mine before long, simply because they can mine so much cheaper here than they can in Oklahoma, and because there are just as good ore deposits here as there are there. There isn't any question about its being cheaper to mine up here, any of the boosters for Oklahoma will admit that. Usually they have water to fight down there. Then they mine deeper, and that costs extra; and the nature of the ground is such as to make it cost most. And labor is higher; and, most important of all, the cost of getting supplies is much greater. This idea of putting down four or five drill-holes on a tract of land and, if nothing is found, condemning it, is absurd. In the John Jackson ground I saw where the drill had been put down within a foot of bonanza 'dirt' and yet of course it didn't show a thing. That has undoubtedly happened hundreds of times in this field. A drill-hole is about 4 in. diameter, so condemning a tract on account of five blank holes means condemning it because 20 in. out of maybe 160 acres failed to show pay-stuff. This camp was originally developed, not by drillers, but by men with picks and



PROSPECTING FOR ZINC ORE IN THE MIAMI DISTRICT, OKLAHOMA

shovels, who developed by sinking shafts. If we had more of that kind around now we would be developing big mines right along. And even with the drills, we are going to have a lot more good times in this camp, where costs are lower than they are in any other part of this district."

MONTANA

Butte.—The expected strike of the local labor unions did not materialize on December 9. Six of the unions voted to strike as a protest to the sentence imposed on T. J. Mooney at San Francisco. One union voted against and the rest of the unions rejected the proposal entirely. At the last the strike order was cancelled.

Owing to the unsettled conditions of the market, all shipments of custom zinc concentrate from Butte to the electrolytic plant at Great Falls have been stopped. The plant can run to full capacity on the large reserve of concentrate on hand, and what the company's own mines will produce. The Butte shippers were the Butte & Superior Mining Co. and the Timber Butte Milling Company.

Saltese.—A large orebody is being developed on the 1000-ft. level of the Tarbox. It is 8 ft. wide and assays well in lead and zinc, with silver and copper.

NEVADA

Battle Mountain.—South-west of this place, 73 miles, M. D. Farretta and Frank Childress are erecting a 12-retort furnace to reduce their cinnabar. John Ross is superintendent.

Belmont.—The Monitor-Belmont mine is expected to be unwatered to the 300-ft. level by January. At the Belmont and Highbridge shafts water is removed by bailing and air-lifts. Old workings above 200 ft. are being examined and sampled.

Goldfield.—In the Spearhead the raise above the 910-ft. level is up 35 ft. Several good stringers were cut. The cross-cut, out 70 ft., also cut similar ore. The raise has not yet reached the shale-latite contact.

Searchlight.—The Big Casino property near here has been leased for a term of years to the Big Casino Leasing Co., F. E. Sharps, manager. This company is gradually getting the mill in shape to handle 50 tons daily with the first unit, consisting of a Hermann ball-mill, two Deister-Overstrom roughing tables, and one five-compartment K & K flotation machine. Two shifts daily are now running, and the third shift is contemplated in the near future. For each ton of coarse concentrate there is produced one-half ton of fine. Concentrate is treated at the Garfield, Utah, smelter of the A. S. & R. Company.

Herman Wessellhoft's copper mine, 10 miles north-east of Searchlight, is producing 12 to 15% ore carrying considerable glance in a micaceous iron gangue, which is being shipped to Garfield.

Thompson.—Ore received by the Mason Valley smelter here averages 750 tons daily. Sources of this ore are the Mason Valley mine at Mason, the Nevada-Douglas mine at Ludwig, and miscellaneous small producers in this region. Production from the Mason Valley mine is from 300 to 350 tons daily, while that from the Bluestone mine is of nearly equal volume. The Ludwig mine has increased its output to 170 tons daily for the last week. Shipments of blister copper are usually at the rate of three carloads per week. The smelter is still operating only one of its two furnaces. It is said that relief is promised for the shortage of coke, and that prospects of blowing-in the second unit are better. The Bluestone mill is treating 300 to 350 tons daily of sulphide ore by flotation. The carbonate ore is sent to the smelter at Thompson.

Tonopah.—Last week this district produced 7548 tons of ore, valued at $128,316.

The Extension is erecting a steel head-frame at its Victor shaft. This was moved from the old Gwin mine near Jackson, California. A Nordberg hoist is to operate at this shaft.

A raise 65 ft. above the 700-ft. level of the MacNamara has cut the Ohio vein. This is the result of considerable exploration. Shares received much attention on the San Francisco Exchange.

During the period March 20 to November 20, 1918, the Cash Boy Consolidated Mining Co. did 1976 ft. of development. The superintendent, W. C. Hellier, reports that the winze was sunk 93 ft. below the 1434-ft. level, from which nearly all exploration was done, until connection was made between the 1527-ft. level and the shaft. A little ore was extracted near the winze. The main winze followed the vein down for 217 ft. Workings from the winze exposed a fair tonnage. In all, 1740 tons was mined, assaying $23,488 net. The shaft was down 1660 ft. by November. From the 1646-ft. point a block of ground is to be prospected. The physical state of the mine is considered to be in better condition than ever before. Cash on hand amounts to $8341.

Production of the principal mines in November was as under.

Mine	Tons	Silver, oz.	Gold, oz.	Profit
Tonopah Belmont	7,944	103,971	1,064	$59,639
Tonopah Extension	9,598	116,717	1,082	53,797
Tonopah Mining	14,900	69,500	770	13,800
Jim Butler	690	.....	....	2,629
West End	....	110,632		.....

OKLAHOMA

Douthat.—A 500-ton (per shift) mill on the Admiralty Zinc Co.'s land, operated by R. Munson and J. J. McLellan, is making good profits treating tailing. Four tons of high-grade concentrate is made per shift, while total costs are only $100.

Picher.—Production of the fields last week totaled 3775 tons of blende and 803 tons of lead, valued at $234,115.

TENNESSEE

Copperhill.—In the suit of the former Russian government against the Tennessee Copper Co., claiming $1,368,000 for non-delivery of some high explosives in 1915, the company has deposited $1,000,000 in New York as a settlement. This cannot be collected as there is no stable government in Russia.

UTAH

American Fork.—The high-grade body of lead ore in the Belorophon mine persists and grows stronger, according to the manager of the Globe mine adjoining.

Bingham.—Utah Consolidated paid 25c. per share, equal to $75,000, on December 24. This makes $1.50 for 1918 and $3.50 for 1917.

Green River.—The U. S. Geological Survey has just reported the results of a reconnaissance made by J. T. Pardee, of 400 square miles in the Green River district south of the Denver & Rio Grande railroad, between Thompson and Green River. The work done included a thorough examination of 20 manganese mines, and a detailed survey of 4 square miles in the vicinity of the Colorado Fuel & Iron mine, made in order to facilitate a close estimate of the ore-reserves.

The manganese ore occurs as irregular lenses or blankets that lie a few feet below the surface along the bedding planes of a gypsiferous, calcareous, red sandstone near the middle of the McElmo formation (Jurassic?); as veins and nodular concretions along joints below the blankets; and as fragments in the soil, residual from the weathering of ore of the two forms first mentioned.

Most of the mines in this district were operated part of the time during 1916 and 1917. At present three operators are producing 400 to 600 tons of high-grade manganese ore per month. Most of this ore comes from the C. F. & I. and Salt Wash mines, operated by the Green River Mining Co.

The other active operators are the Needles Mining Co. and J. B. Fonder.

The deposits are worked solely by open-pits. The bedded deposits (blankets) bear an overburden ranging in thickness from a few inches to 6 ft., which is stripped off by hand or with plow and scraper. It is rarely profitable to mine them by driving under cover or to remove more than 6 ft. of overburden. Residual fragments of manganese ore are separated from the soil by dry screening and hand picking.

At the C. F. & I. mine a revolving-screen, driven by a gasoline engine, has been discarded for one-man hand-shaking screens and stationary sloping-screens such as are commonly used by mortar-mixers to clean sand. In this way one man can produce from 1000 to 2000 lb. of ore per day. The quantity of ore produced from the blankets by one man is variable, but averages nearly the same as that obtained from the residual deposits.

Miners' wages are $3.75 and $4, and board is $1.25 per day. The cost of hauling ore to the railroad from the C. F. & I. mine is $4 per ton, and the cost at the other mines ranges from $4 to $9. Loading, hauling, water, and other expenses bring the cost of a ton of ore on board the cars up to a price ranging from $17 to $25. The operators report difficulty in obtaining sufficient labor to work the mines at full capacity. It is estimated that a monthly output of at least 800 tons can be maintained during the remainder of 1918 without modifying existing methods of mining or adding greatly to the equipment on hand, if a sufficient number of miners can be had.

On May 20, 1918, there were 262 tons of ore on the loading platforms at Crescent and Floy awaiting shipment. Approximately half of this was selected ore carrying about 80% MnO_2, a grade known as 'di-oxide' ore by the operators. The remainder carries more than 40% Mn, and is classified by the operators as 'furnace' or 'metallic' ore.

Mr. Pardee estimates that 7300 tons of high-grade ore (containing more than 40%) is available for mining under present conditions and without modification of existing methods. Most of this may be classified as furnace ore, though a considerable part of it could be hand-sorted to di-oxide ore. About two-thirds of the quantity estimated is contained in the blankets and the remainder in the residual deposits. The above estimates include 20 mines, two of which supply more than half the total. In addition, 22,500 tons, chiefly in the residual surface deposits, are possibly available to mining under improved conditions or methods. Some way other than hand-picking should be devised to separate the rock fragments from the ore.

Under present conditions the ore in the Green River district that contains much less than 40% Mn cannot perhaps be mined profitably, but such ore happens to be not very abundant. About 5000 tons of ore containing from 15 to 40% and considerable lime is available for mining. In addition there is a considerable amount of ore containing smaller quantities of manganese and much silica, most of it in abandoned claims at what is known as the Court House.

Park City.—The Judge M. & S. Co. paid 12½c. per share, equal to $37,500, last week. This makes $240,000 for 1918.

Salt Lake City.—Protest against the collection of a tax on the net earnings of mining companies by the State Treasurer was made in the District Court on November 13, when more than twenty of the more prominent mining companies of the State filed actions seeking to restrain the State Treasurer from collecting any but the occupational tax and asking for an injunction to prevent the sale of properties to satisfy the taxes.

The law against which protest is made provides for a tax of $1 per annum from all concerns or individuals engaged in mining business in Utah and an additional 2% per annum on the net proceeds, with the exception of the taxes for 1917, which are now being collected on the basis of 3% on the net proceeds. In the complaint the constitutionality of the law is questioned as a violation of the Constitution of the United States, the fourteenth amendment to the Federal constitution and the State constitution. The fourteenth amendment prohibits the confiscation of property without due process-of-law. It is maintained that the occupational tax and the tax on net earnings constitutes double taxation, because it taxes the proceeds at a greater rate than is imposed on other taxable property in the State, in violation of Sections 3 and 4 of Article 13 of the State constitution. It is further maintained that the law subjects the mines to a tax for a definite purpose in excess of that which is imposed upon other taxable property, and deprives the owners of their property without due process-of-law, and that the action of the State Treasurer, if permitted to sell the properties as he has advertised, will place the title to the properties in doubt.

Among those joining in the suit are the Utah Copper Co., the Judge Mining & Smelting Co., and the Silver King Consolidated Mining Company.

A preliminary hearing in the matter was held by Judge T. D. Johnson, in the Federal Court, on the 14th, to decide on the question of temporary injunction.

WASHINGTON

Newport.—A 100-ton concentrator is being erected by the Bead Lake Copper Co. on the Pend Oreille river north of Newport.

Spokane.—E. S. Campbell and associates of Spokane have taken an option for $200,000 on the Crystal property in Lincoln county, 35 miles west of this place. The Crystal was located 23 years ago by John Gray of Spokane, who has since carried on some development.

CANADA

British Columbia

Ainsworth.—The Florence Silver Mining Co. paid a Christmas dividend of 1 cent per share, equal to $10,000. The mine produces lead-silver-zinc ore.

Hedley.—The Hedley Gold Mining Co. pays 15c. per share, $18,000, on December 31.

Sandon.—The manager of the Queen Bess Mining Co., O. A. Thomas, reports that the concentrator being erected at that property is almost ready. During the past eight months $50,000 of machinery has been purchased. The Queen Bess is a silver-lead-zinc mine, located in 1895. Until a short time ago it lay dormant. The steady development that has proceeded for the past two years has given the company considerable ore-reserves. A shaft has been sunk a depth of 300 ft., which Mr. Thomas says proves the persistence of the orebodies of the district.

Manitoba

Le Pas.—According to the contractor for hauling ore, C. B. Morgan, 10,000 tons was shipped from the Mandy mine in the Flin Flon district this season. The company is to double its output.

Ontario

Cobalt.—The Nipissing company produced silver worth $281,078 during November. At the high-grade mill 181 tons yielded $109,461, and at the low-grade mill 6345 tons returned $171,617. The refinery handled 401,552 oz., including custom metal. The total output for 11 months is $3,280,672, almost equal to the whole of 1918. In a winze being sunk on vein 544 on No. 6 level of No. 73 shaft, at a depth of 35 ft. there is 2 in. of 1200 to 2000-oz. ore. A cross-vein at some depth assays 1500 oz. across 1½ in. General conditions underground are favorable.

Kerr Lake produced 169,491 oz. of silver during November.

Following the dispute between La Rose company and O'Brien, G. E. Booth, connected with the La Rose, has

staked what is purported to be a fraction between the Violet and O'Brien properties. The staking was done on November 5, and application to record was filed with the Mining Recorder on the 20th. The fraction applied for is a strip, about 160 ft. wide on the north end, running down to a point on the extreme south end. In the staking is the Violet shaft and part of the workings underground, besides buildings on surface. This opens a new phase of the dispute regarding the boundary. M. J. O'Brien Limited applied for a declaration by the Supreme Court of the rights of themselves and the La Rose company some days ago. It was thought that an injunction was the next move, but the 'Northern Miner' is informed that the proceedings will be commenced without an injunction.

The Hudson Bay Mines company has issued its report for the year ended August 31, 1918. The company has a mine at Cobalt, the Dome Lake at Porcupine, and claims at Gowganda and Kirkland Lake. No work was done at the last named. The Dome Lake is developing fairly well. Cyanidation was added to the amalgamating plant, increasing extraction 25%, to 87%. Ore-reserves in the Cobalt mine total 12,224 tons, containing 60,149 oz. of silver. The mill treated 20,540 tons of 9.5-oz. ore, extracting 72,502 oz. The profit was $32,402, which, added to the previous balance, makes $132,636 at credit. Mining and milling cost $4.493 per ton.

KOREA

Unsan.—Oriental Consolidated reports the clean-up for November yielding $122,000.

MEXICO

Chihuahua

Parral.—The Alvarado M. & M. Co. is to increase its mill capacity from 500 to 600 tons daily. The present output is $200,000 of silver monthly. According to the general manager, T. G. Hawkins, in a statement to the El Paso 'Herald', "We are working three groups of properties—the Palmilla, Las Cruces, and Veta Colorado. For the first named we have shipped the centrifugal pump of 1500 gal. per min. The mine makes 1200 gal. This pump is to handle the water in the new shaft of the Palmilla, 200 ft. below our old 600-ft. level. On the Veta Colorado we have put the Alfarena shaft down to 900 ft., have thoroughly prospected ground below water with diamond-drills, and discovered large bodies of high-grade ore. We have found ore running as high as 30 kg. (960 oz.) per ton. One very large body, principally of milling ore, is 40 ft. wide, with rich streaks. At the bottom of this shaft, which is in the foot-wall, we have just installed a 200-hp. centrifugal electric pump to handle the water. We have cross-cut from this shaft to within 15 ft. of the vein, and will begin immediately to pump this new ground. Our company is milling only its own ore. We use the cyanide process, and our silver is 859 fine. We have three aerial tramways for ore transportation from the mines to the mill. A. W. Morris is metallurgist, and Fred Marston, mill superintendent."

Cusihuiriachic.—Villa's main command, which passed through this place on December 18, destroyed property of the Cusi Mining Co. valued at $20,000. The American officials escaped before Villa arrived.

Tamaulipas

Tuxpam.—The Potrero del Llano gusher of the Aguila Oil Co. is reported to have ceased yielding oil. For over 8 years it has produced 50,000 bbl. daily, the limit that could be conveniently handled. When 'brought-in' the output was 120,000 bbl., which was maintained until recently. The depth of this well was 3200 ft. The oil was conveyed to ships, 6 miles out in the gulf, by the submerged pipe-line and floating loading-station that has frequently been described.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments The information is interesting to our readers.

Pope Yeatman has returned from France to New York.

Spencer C. Browne, Jr., has returned to New York from San Francisco.

Robert C. Gemmell, manager for the Utah Copper Co., is in San Francisco.

Aubrey S. Wheler sailed on the 'Siberia Maru' on December 21 for Shanghai.

S. Herbert Williams, now resident at Ely, Nevada, spent last week in San Francisco.

W. L. Creden has resigned as manager for the Davis-Daly Copper Co. of Butte, Montana.

P. A. Robbins has opened an office as consulting engineer in the Hobart Bdg., San Francisco.

Mark R. Lamb sailed from New York on the 'Adriatic' on December 23, on his way to France.

H. S. Mudd, who has been serving with the U. S. Bureau of Mines, has returned to Los Angeles.

R. K. Humphrey is general manager of the Belle Union and New Mohawk mines, at Chloride, Arizona.

W. T. Pearce, of the Marranboy Tin Fields Company in the Northern Territory of Australia, is at the Whitcomb hotel.

J. Power Hutchins, having entirely recovered from a severe attack of influenza, has returned from San Francisco to New York.

D. M. Folsom has been appointed assistant to the president of the General Petroleum Corporation, Capt. John Barneson.

N. H. Emmons has left the Air Nitrates Corporation to resume consulting practice, establishing himself at Lynchburg, Virginia.

G. L. Carlisle, Jr., who has been working with the Emergency Fleet Corporation, has returned to engineering practice at 14 Wall St., New York.

Walter Broadbridge, Captain in the British Army, metallurgist and mining engineer to Minerals Separation Ltd., London, is at the St. Francis hotel.

E. K. Soper, formerly Dean of the Oregon School of Mines, has resigned his position at that institution, and will go to the West Indies on a geologic reconnaissance.

E. B. Thornhill has resigned as manager of the New York office of the General Engineering Co. to become research engineer for the Chino Copper Co. at Hurley, New Mexico.

H. R. Plate has returned from a business trip to New York. Mr. Plate and his associates are forming an exploration company to operate the Sheep Ranch mine in Calaveras county, California.

E. E. Campbell, superintendent of the Anyox B. C. mine of the Granby Consolidated Mining & Smelting Co., and **O. B. Smith,** general superintendent of the company's mining operations, have returned to Anyox after visiting the Ketchikan district of northern British Columbia.

W. H. Staver, who superintended the Liberty Bell at Telluride, Colorado, for a number of years, has returned to New York from Brazil and opened an office at 15 Broad street. While in Brazil he acted as mine manager for E. J. Lavino & Co., in the Bomfim, Santa Luzia, and Saude districts, in the State of Bahia.

The postponed meeting to organize a local chapter of the American Mining Congress in San Francisco will be held on January 15 and 16. An interesting program is being arranged.

THE METAL MARKET

METAL PRICES

San Francisco, December 24

Aluminum-dust, large and small lots, cents per lb	65—70
Antimony (wholesale), cents per pound	10.00
Copper, electrolytic, cents per pound, in carload lots	26.00
Copper, electrolytic, cents per pound, in small quantities	27.35
Lead, pig, cents per pound	6.75— 7.25
Platinum, per ounce	$108
Quicksilver, per flask of 75 lb	$110
Spelter, cents per pound	10.00
Zinc-dust, cents per pound	16.00

ORE PRICES

December 24

Chrome, no definite quotations available.	
Fluorspar, 85% CaF_2, f.o.b. shipping point, or San Francisco, per ton	$22—$30
Manganese, domestic, 35 to 54%, f.o.b. South Chicago, per unit (Government price, effective May 29)	$0.86—$1.30
Manganese, domestic, 35 to 45%, f.o.b. east of South Chicago, per unit (Government price, effective May 29)	$1.01—$1.45
(Manganese, domestic, penalty of 50c. to $1 per ton for 8% and up to 25% silica, and bonus of 50c. to $1 for less than 8 and 5%.)	
Molybdenite, per lb., 90% MoS_2	$0.85
Pyrite, per unit of sulphur, cents	28—32
Tungsten, 60% WO_3, per unit	$17—$23

EASTERN METAL MARKET

(By wire from New York)

December 24.—Copper is inactive. The official price is 26 cents, but re-sale offerings are 23 cents. Lead is dull and lower. The market was declared open on the 21st. Spelter is lifeless and easy.

COPPER

On September 21, 1917, the Government fixed copper prices at 23.50c. per lb. for large lots, and 24.67½c. for small lots, effective until June 1, 1918. On this date the prices were re-fixed until August 15; but on July 2 the price was increased to 26c. and 27.35c., respectively, until August 15 On August 7 the current rates were again fixed until November 1, which have since been extended to January 1, 1919, prices to be effective on the day of shipment, not the day of sale. Quotations in cents per pound are as under:

Date		Average week ending	
Dec.	18	Nov.	12
"	19	"	19
"	20	"	26
"	21	Dec.	3
"	22 Sunday	"	10
"	23	"	17
"	24	"	24

	26.00		26.00
	26.00		26.00
	26.00		26.00
	26.00		26.00
			26.00
	26.00		26.00
	26.00		26.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	24.30	29.53	23.50	July	25.66	29.67	26.00
Feb.	26.62	34.57	23.50	Aug.	27.03	27.42	26.00
Mch.	26.65	36.00	23.50	Sept.	28.28	25.11	26.00
Apr.	28.02	33.16	23.50	Oct.	28.50	23.50	26.00
May	29.02	31.69	23.50	Nov.	31.95	23.50	26.00
June	27.47	32.57	23.50	Dec.	32.89	23.50	....

Re-sale copper is said to be offered as low as 19c. per lb. in large quantities by consumers who have stocks, the result of cancellation of orders.

Leading copper producers on December 17 formed the Copper Export Association. The capital is $250,000 in 7% preferred stock and 500 common shares of no par value. John D. Ryan is president. The object of the Association is for producers to unite to facilitate foreign trade. This is permissible under the Webb law.

LEAD

Lead is quoted in cents per pound, New York delivery. Early in July, producers agreed to fix prices at 8.05c. per lb., New York. This was reduced to 7.05c. on December 2. On the 21st all restrictions were removed from lead, the market now being free.

Date		Average week ending	
Dec.	18	Nov.	12
"	19	"	19
"	20	"	26
"	21	Dec.	3
"	22 Sunday	"	10
"	23	"	17
"	24	"	24

	6.50		8.05
	6.50		8.05
	6.45		8.05
	6.45		7.85
			7.05
	6.40		7.05
	6.40		6.45

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	5.95	7.64	6.85	July	6.40	10.93	8.03
Feb.	6.23	9.10	7.07	Aug.	6.28	10.75	8.05
Mch.	7.26	10.07	7.26	Sept.	6.86	9.07	8.05
Apr.	7.70	9.38	6.99	Oct.	7.02	6.97	8.05
May	7.38	10.29	6.88	Nov.	7.07	6.38	8.05
June	6.88	11.74	7.58	Dec.	7.55	6.49	....

SILVER

Below are given official (not Government) quotations, in cents per ounce of silver 999 fine. In order to make prompt settlements with smelters and brokers, producers allow a discount from the maximum fixed price of $1.01½, hence the lower price. The Government has not fixed the general market price at $1, but will pay this price (as from April 23, 1918) for all silver purchased by it. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the current rate of exchange. On August 15, 1918, the Treasury announced that the maximum price was fixed at $1.01½ per ounce. The British government fixed its maximum at 49½ pence, on September 2, but on November 12 this was changed to 48¾ pence, due to a drop in price.

Date	New York,	London
Dec. 18	101.12	48.75
" 19	101.12	48.75
" 20	101.12	48.75
" 21	101.12	48.75
" 22 Sunday		
" 23	101.12	48.75
" 24	101.12	48.75

Average week ending	
Nov. 12	101.12
" 19	101.12
" 26	101.12
Dec. 3	101.12
" 10	101.12
" 17	101.12
" 24	101.12

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	56.76	75.14	88.72	July	63.06	78.92	99.02
Feb.	56.74	77.54	85.79	Aug.	66.07	85.40	100.31
Mch.	57.89	74.13	88.11	Sept.	68.51	100.73	101.12
Apr.	64.37	72.51	95.35	Oct.	67.86	87.38	101.12
May	74.27	74.61	99.50	Nov.	71.60	85.97	101.12
June	65.04	76.44	99.50	Dec.	75.70	85.97	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound. On May 25, 1918, the Government fixed prices until September for grade A spelter at 12c. per lb. for itself and the open market. This is to be continued until January 1, 1919, the price at point of delivery to be at East St. Louis plus freight. Lower grades can make their own prices as usual. Sheet-zinc is fixed at 15c., and plate at 14c. per pound.

Date		Average week ending	
Dec.	18	Nov.	12
"	19	"	19
"	20	"	26
"	21	Dec.	3
"	22 Sunday	"	10
"	23	"	17
"	24	"	24

	8.50		8.91
	8.50		8.62
	8.45		8.61
	8.45		8.87
			8.61
	8.40		8.58
	8.40		8.45

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	18.21	9.75	7.87	July	9.90	8.98	8.72
Feb.	19.99	10.45	7.97	Aug.	9.03	8.58	8.87
Mch.	18.40	10.78	7.67	Sept.	9.18	8.33	9.58
Apr.	18.62	10.20	7.04	Oct.	9.92	8.32	9.11
May	16.01	9.41	7.39	Nov.	11.81	7.76	8.75
June	12.85	9.63	7.92	Dec.	11.26	7.84	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. The Government was taking 40% of the United States quicksilver output, paying therefore $105 per flask, and will continue to pay this until contracts are completed. Outside of this business the competitive market can make any price as usual. Prices, in dollars per flask of 75 pounds.

Date		Dec.	10
Nov.	26	"	17
Dec.	3	"	24

	120.00		120.00
	120.00		110.00
			110.00

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	222.00	81.00	128.06	July	81.20	102.00	120.00
Feb.	295.00	126.25	118.00	Aug.	74.50	115.00	120.00
Mch.	219.00	113.75	112.00	Sept.	75.00	112.00	120.00
Apr.	141.60	114.50	115.00	Oct.	78.20	102.00	120.00
May	90.00	104.00	110.00	Nov.	79.50	102.50	120.00
June	74.70	85.50	112.00	Dec.	80.00	117.42	....

TIN

Prices in New York, in cents per pound. The monthly averages in 1918 are nominal. Under the international agreement, the United States is to get 66% of the world's supply of tin; but this control ends on January 1, 1919. On December 3 the War Industries Board fixed the price to consumers and jobbers at 72½c. f.o.b. Chicago and Eastern points, and 71¼c. on the Pacific Coast.

Monthly averages

	1916	1917	1918		1916	1917	1918
Jan.	41.76	44.10	85.13	July	38.37	62.60	93.00
Feb.	42.60	51.47	85 00	Aug.	38.88	62.53	91.37
Mch.	50.50	54.27	85.00	Sept.	36.66	61.54	80.40
Apr.	51.49	55.63	88.53	Oct.	41.10	62.24	78.82
May	49.10	63.21	100.01	Nov.	44.12	74.18	73.63
June	42.07	61.93	91 00	Dec.	42.55	85.00	....

Manganese Alloys: There has been no test of the market, there being no demand. Quotations are unchanged at $240 to $250, delivered, for 70% ferro and $70, furnace, for 16 to 22% spiegel. A representative here of a British ferro-maker has secured a license to import over 1000 tons of British alloy to apply on an old contract.

Eastern Metal Market

New York, December 18.

The trend of events points to entirely free markets in all the metals after January 1, except possibly in the case of tin.

There is no buying of copper.

The tin market is lifeless and in a state of readjustment.

The lead market has fallen on account of offerings of re-sale metal.

The zinc market is entirely flat, but the tone is steady.

Antimony has declined on more liberal offerings and less demand.

An open market in steel is the outcome of the recent meeting at Washington between the War Industries Board and the steel-makers. A suggestion from the latter that a lower maximum-price schedule prevail for the first quarter was rejected. Automatically the market becomes an open one, and already 6000 tons of plate has sold at 3c. per lb. for January delivery, or ¼c. under the Government maximum price. Some steel companies refuse to recognize any lower schedule, but all indications point to lower levels in steel products in particular. Pig-iron makers feel that they will be able to continue to get the old prices. The new prices, or those that were to have been proposed, are from $3 to $5 per ton lower than present Government levels.

COPPER

A meeting is scheduled for Friday, December 20, at Washington, between the Copper Producers' Committee and the War Industries Board as to the future control of the market after January 1. Judging by the recent course of events in the steel market, where all control has been abandoned, a like issue is expected in copper and an open market will probably prevail before the beginning of 1919, if not earlier. The fact that an agreement exists that the price of copper be maintained at 26c. until January 1 renders any sales under this level unlikely, yet it may occur. At present there is no demand at all, and the market is lifeless. The Government has let it be known officially that any stocks of copper it may have in hand will not be thrown on the market so as to unstabilize it, or in other words, the Government will not be a competitor with producers. This has been an encouraging factor in the situation, for it is known that the Government has large unused stocks in its possession. It is probable that producers will be able to stabilize the market after January 1, for a time at least, their experience under war conditions standing them in good stead. One large dealer expresses the opinion that the market may recede for a time, then gradually advance to a stable price-level. Stocks of refined metal in the country are undoubtedly large, estimates placing them as high as 800,000,000 pounds.

TIN

So far as international control of the tin market is concerned, this may be said to have ceased. The Tin Executive in London has ceased to function as a purchaser, and all allocations of metal there have been abandoned. The entire scheme of international control ends officially on January 1, but so far as the United States is concerned this may not be said to be true until all the metal that has been allocated to the United States Steel Products Co. has been disposed of to consumers at cost. Left to the usual channels and under present conditions with consumers well stocked, this would take a long time. It may now be said that Tin Importers' Association here has offered a plan to the War Industries Board whereby the entire problem is capable of more rapid solution. By this scheme a survey of stocks on hand and to arrive is to be made, and then an estimate made of the time necessary for consumption. If this should figure out to be April 1, then future tin buying could begin through importers' channels; but each consumer would have to buy as much prompt tin from the U. S. Steel Products Co. as he desires of future tin, receiving at the same time a certificate of purchase for the former. In no other way could he buy future tin. Such certificates under the plan could be made negotiable so that a consumer not needing prompt tin could sell his certificate and thus reduce the cost of his purchases. It is believed that some such plan may be adopted, and the entire market gradually brought back to its previous status. Consumers are not coming into the market and taking freely metal from the U. S. Steel Products Co.; they are apparently well stocked. Demand for prompt metal is light, and such light sales of re-sale metal as have been made have gone at 72c., New York, which is the nominal market. The fixed price of the tin allocated to this country and in the hands of the U. S. Steel Products Co. is 72.50c., New York and Chicago, and 71.25c., Pacific ports. Arrivals so far this month have been 1600 tons at Pacific ports and 30 tons at Atlantic. Future standard tin is quoted in London at £269 per ton.

LEAD

The market is lifeless and presents a decided contrast to that of only four or five weeks ago. Then a maximum price of 8.05c., New York, ruled, and the metal was scarce. Now an agreed price of 7.05c. is disregarded, and re-sale metal in the hands of consumers is being offered as low as 6.40c., St. Louis, or 6.75c., New York, with no one desirous of buying it. We quote the market as nominal at these levels with the official maximum price at 7.05c., New York, or 6.75c., St. Louis. It is probable that prompt metal could be bought today at 6.75c., New York. The control of the market, which is still technically in the hands of the Lead Producers' Committee, will probably cease January 1.

ZINC

Buying by galvanizers has subsided, and brass-makers are entirely out of the market. As a result the market has become very dull. Prime Western for early delivery is quoted largely nominal at 8.15c., St. Louis, or 8.50c., New York, with first quarter at about 7.85 to 8c., St. Louis, or 8.20 to 8.35c., New York. The maximum price of 12c. per lb. for grade A zinc will disappear on January 1, as well as those of 15c. and 14c., respectively, for sheet and plate-zinc. It is understood the Government has large stocks of grade A on hand which it will not indiscriminately put on sale so as to unduly unsettle a normal readjustment.

ANTIMONY

This market has again declined, due to fairly large offerings of wholesale lots for December, January, and February delivery. It may now be quoted at 8 to 8.25c., New York, duty paid, for prompt and early delivery.

ALUMINUM

While ample supplies of metal are being allocated to domestic uses, Government maximum prices continue to control the market at 33c. per lb. for 50-ton lots, at 33.10c. per ton for 15 to 50-ton lots, and at 33.20c. per ton for 1 to 15-ton lots.

TUNGSTEN

It is stated that representatives of ore consumers, sellers, etc., made a recommendation to the War Trade Board that a duty be imposed on imports of ore and that none be imported for at least three months. This was refused them.

Dividends From Mines, United States and Canada

UNITED STATES

Company and situation	Metal	Shares issued	Par value	Paid in 1918	Total	Latest dividends Date	Amount
Ahmeek, Michigan	copper	200,000	$25.00	2,000,000	10,450,000	Dec. 31, 1918	$2.00
Allouez, Michigan	copper	100,000	25.00	750,000	.....	Dec. 31, 1918	1.50
American Z. L. & S., United States.	c.l.s.g.	96,560	25.00	289,680	.....	Nov. 1, 1918	1.50
Anaconda, Montana	c.z.s.g.	2,331,250	50 00	18,650,000	156,357,500	Nov. 25, 1918	2.00
Atolia, California	tungsten	100,000	1.00	600,000	.....	Sept. 15, 1918	0.50
Arizona, Arizona	copper	1,519,896 £316,530 7% pfd.	1.20	112 000	2,190,000 21,168,000	Mch. 31, 1918 Aug. 21, 1918	... 0.36
Arizona Commercial, Arizona	c g.s.	175,000	5.00	262,500	.....	Oct. 31, 1918	0.50
Barnes-King, Montana	gold	400,000	5.00	160,000	260,000	Nov. 15, 1918	0.10
Bingham Mines, Utah	l.s g.	150,000	10.00	375,000	625,250	Dec. 31, 1918	0.50
Bunker Hill & Sullivan, Idaho	l.s.	327,000	10.00	1,553,250	22,086,750	Dec. 4, 1918	0.50
Butte Copper & Zinc, Montana	c.z.mn.	411,700	5.00	205,800	205,800	July 30, 1918	0.50
Caledonia, Idaho	l.s.	2,605,000	1.00	479,800	3,699,100	Jan. 6, 1919	0.01
Calumet & Arizona, Arizona	copper	642,462	10 00	5,139,696	41,132,658	Dec. 23, 1918	2.00
Calumet & Hecla, Michigan	copper	100,000	25.00	5,500,000	150,750,000	Dec. 31, 1918	15.00
Centennial, Michigan	copper	90,000	25.00	180,000	.....	Dec. 31, 1918	1.00
Center Creek, Missouri	z.l.	100,000	10.00	10,000	660,000	April 1, 1918	0.05
Champion, Michigan	copper	100,000	25.00	1,280,000	22,634,541	Aug. 15, 1819	6.40
Chief Con., Utah	l.z.s.g.c.	884,223	1.00	287,370	1,124,341	Aug. 3, 1918	0.02½
Chino, New Mexico	copper	869,980	5.00	3,915,010	25,098,172	Dec. 31, 1918	1.00
Cerro Gordo, California	l.z.s.	975,000	1.00	.....	175,000	Oct. 15, 1917	0.05
Copper Range, Michigan	copper	394,399	25.00	2,366,394	24,822,921	Dec. 14, 1918	1.50
Con. Interstate-Callahan, Idaho	z.l.s.	464,990	10.00	813,733	7,091,098	Oct. 21, 1918	0.75
Continental Zinc, Missouri	z.l.	22,000	5.00	11,000	396,000	Jan. 2, 1918	0.50
Con. Arizona, Arizona	c.s.g.	1,663,000	5.00	498,900	831,500	Dec. 17, 1918	0.05
Cresson, Colorado	gold	1,220,000	1.00	1,464,000	7,149,163	Dec. 10, 1918	0.10
Daly, Utah	l.s.g.	150,000	20.00	45,000	3,030,000	Oct. 1, 1918	0.10
Davis-Daly, Montana	copper	600,000	10.00	450,000	450,000	Dec. 30, 1918	0.25
Dragon Con., Utah	c.l.s.g.	1,875,000	1.00	56,750	131,250	July 25, 1918	0.01
Ducktown, Tennessee	copper	198,000	4.80	.....	2,678,702	May, 1917	0.96
Eagle & Blue Bell, Utah	l c.z.s	893,146	1.00	267,945	1,162,461	Sept. 20, 1918	0.10
East Butte, Montana	copper	411,000	10.00	616,000	.....	Dec. 21, 1918	1.50
Electric Point, Washington	lead	793,500	1.00	87,255	253,785	Dec. 24, 1918	0.05
Elko Prince, Nevada	gold	1,108,566	1.00	110,856	166,284	April, 1918	0.05
Empire, Idaho	copper	1,000,000	1.00	100,000	880,000	July 1, 1918	0.05
Engels, California	copper	1,791,926	1.00	268,789	.....	Oct. 1, 1918	0.01½
Federal, Idaho	l.z.s.	120,000	100.00	629,271	14,555,723	Sept 15, 1918	1.75
First National, California	copper	600,000	5.00	90,000	570,000	Aug. 1918	0.15
General Development, U. S	.....	120,000	25.00	330,000	4,913,917	Sept. 3, 1918	1.00
Golden Cycle, Colorado	gold	1,500,000	1.00	135,000	8.313,500	Mch. 10, 1918	0.03
Grand Central, Utah	l.s.	600,000	1.00	54,000	1,802,000	Dec. 21, 1918	0.03
Hecla, Idaho	l.s.	1,000,000	0.25	150,000	7,105,000	Sept. 28, 1918	0.15
Homestake, South Dakota	gold	251.160	100.00	1,506,960	41,626,000	Dec. 26, 1918	0.50
Inspiration, Arizona	copper	1,181,967	20.00	7,091,802	23,027,147	Oct. 28, 1918	2.00
Iron Blossom, Utah	l.s.g.	1,000,000	0.10	75,000	3,175,000	Oct. 25, 1918	0.02½
Iron Cap, Arizona	copper	144,872	10.00	325,938	670,415	Sept. 2, 1918	0.25
Isle Royale, Michigan	copper	150,000	25.00	375,000	.....	Dec. 31, 1918	0.50
Jim Butler, Nevada	s.g.	1,718,021	1.00	311,802	1,170,813	July, 1918	0.07
Judge M. & S., Utah	l.z.c.s.g.	480,000	1.00	240,000	2,310,000	Dec. 20, 1918	0.12½
Kennecott, Alaska	copper	2,786,679	5.00	11,146,716	.....	Dec. 31, 1918	1.00
Magma, Arizona	copper	240,000	5.00	360,000	1,784,000	Jan. 6, 1919	0.50
Mary Murphy, Colorado	g.s.l.z.	370,000	5.00	.....	93,106	April, 1916	0.07
Mass Con., Michigan	copper	100,000	25.00	.....	500,000	Aug. 15, 1917	1.00
Miami, Arizona	copper	747,114	5.00	3,362,013	19,595,044	Nov. 15, 1918	1.00
Mohawk, Michigan	copper	100,000	25.00	800,000	.....	July 1, 1918	2.00
Nevada Con., Nevada	copper	1,999,457	5 00	6,498,235	46,780,027	Dec. 31, 1918	0.75
Nevada Packard, Nevada	silver	1,164,592	1.00	29,117	87,351	Sept. 2, 1918	0.02½
Nevada Wonder, Nevada	s.g.	1,500,000	1.00	150,000	1,200,000	Nov. 21, 1918	0.10
New Cornelia, Arizona	copper	1,200,000	5.00	300,000	300,000	Nov. 25, 1918	0.25
New Idria, California	quicksilver	100,000	5.00	150,000	2,680,000	Oct. 1, 1918	0.50
New Jersey Zinc, New Jersey	zinc	350,000	100.00	5,600,000	.....	Nov. 1918	4.00
North Butte, Montana	c.s.g.	430,000	15.00	430,000	14,667,000	Oct. 28, 1918	0.25
North Star, California	gold	250,000	10.00	50,000	5,337,040	Mch. 29, 1918	0.20
Old Dominion, Arizona	c.s.g.	293,353	25.00	880,059	13,774,244	Sept. 30, 1918	1.00
Ontario Silver, Utah	s.l.	150,000	100.00	75,000	15,187,000	Jan. 4, 1919	0.50
Osceola, Michigan	copper	96,150	25.00	961,500	17,371,775	Dec. 31, 1918	2.00
Phelps Dodge, Ariz., N. Mex., Mex.	c.s.g.	450,000	100.00	13,500,000	80,096,527	Dec. 30, 1918	8.00
Plymouth Con., California	gold	240,000	4.80	57,600	518,400	Jan. 31, 1918	0.24
Portland, Colorado	gold	3,000,000	1.00	300,000	11,257,000	Oct. 21, 1918	0.02
Prince Con., Nevada	l.s.	1,000,000	2.00	.....	575,000	Nov. 1, 1917	0.02½
Quincy, Michigan	copper	110,000	25.00	935,000	26,452,500	Dec. 23, 1918	2.00
Ray Con., Arizona	copper	1,577,179	10.00	5,125,831	20,681,083	Dec. 31, 1918	0.75
Rochester Mines, Nevada	s.g.	2,148,791	1.00	89,930	89,930	Oct. 1, 1918	0.02
Shannon, Arizona	copper	300,000	10.00	.....	1,425,000	Nov. 15, 1917	0.25
Shattuck, Arizona	c.l.s.g.	350,000	10.00	700,000	7,087,500	Oct. 19, 1918	0.50
Silver King Con., Utah	l.s.c.g.	700,000	1.00	70,000	1,562,705	April 1, 1918	0.10
St. Joe Lead, Missouri	lead	1,464,780	10 00	2,197,170	12,730,000	Dec. 20, 1918	0.50
Tamarack & Custer, Idaho	l.s.	1,776,500	1.00	213,148	.....	Aug. 27, 1918	0.06
Tennessee Copper, Tennessee	copper and acid	391,498	no par value	391,498	.....	May 15, 1918	1.00
Tintic Standard, Utah	l.s.	1,175,000	0.10	307,193	398,873	Dec. 20, 1918	0 10
Tomboy, Colorado	g s.	310,000	4.80	37,200	4,074,200	June 28, 1918	0 12
Tom Reed, Arizona	gold	909,555	1.00	18,191	2,620,000	Dec. 1918	0.02
Tonopah Belmont, Nevada	s.g.	1,500,000	1.00	337,500	9,480,559	July 1, 1918	0.10
Tonopah Extension, Nevada	s.g.	1,282,801	1.00	64,140	1,912,399	Jan. 1, 1919	0.05
Tonopah Mining, Nevada	s.g.	1,000,000	1.00	300,000	14,875,000	Oct. 21, 1918	0.15

Company and situation	Metal	Shares issued	Par value	Paid in 1918	Total	Latest dividends Date	Amount
United Copper, Washington	copper	1,000,000	1.00	.....	150,000	Oct. 15, 1917	0.01
United Eastern, Arizona	gold	1,363,000	1.00	776,910	1,186,010	Dec. 30, 1918	0.07
U. S. S. R. & M., U. S., Mexico	l.z.c.s.g.	pfd. 486,350 / com. 351,115	50.00 / 50.00	1,702,224	21,476,817 / 11,190,175	Oct. 15, 1918 / Oct. 15, 1918	0.87½ / 1.25
United Verde Copper, Arizona	copper	300,000	no par value	5,100,000	51,047,000	July 18, 1918	1.50
United Verde Extension, Arizona	copper	1,050,000	0.50	2,360,000	.....	Feb. 1, 1919	0.75
Union Con., Nevada	s.g.	200,000	1.00	80,000	.....	July 1918	0.05
Utah Apex, Utah	c.l.s.g.	528,200	5.00	132,050	990,375	Aug. 10, 1918	0.25
Utah Con., Utah	c.l.s.g.	300,000	5.00	450,000	12,735,000	Dec. 24, 1918	0.25
Utah Copper, Utah	copper	1,624,490	10.00	16,244,900	92,016,183	Dec. 31, 1918	2.50
Utah Metal, Utah	l.c.g.s.	691,588	1.00	.....	895,734	Dec. 10, 1917	0.30
Vindicator Con., Colorado	gold	1,500,000	1.00	60,000	3,772,500	Oct. 25, 1918	0.01
Wellington Mines, Colorado	l.z.	1,000,000	1.00	100,000	1,750,000	Jan. 1, 1918	0.10
West End, Nevada	s.g.	1,788,486	5.00	357,698	1,073,092	Oct. 16, 1918	0.10
Wolverine, Michigan	copper	60,000	25.00	240,000	10,130,000	Jan. 2, 1919	1.00
Yellow Aster, California	gold	1,064,310	1.00	35,000	1,245,789	July 20, 1917	0.05
Yellow Pine, Nevada	z.l.	1,000,000	1.00	300,000	2,310,000	Dec. 16, 1918	0.12
Yukon Gold, Alaska, Cal., Nev.	gold	3,500,000	5.00	87,500	.....	Mch. 30, 1918	0.02½
CANADA							
Buffalo, Ontario	silver	1,000,000	1.00	250,000	3,287,000	Aug. 10, 1918	0.25
Coniagas, Ontario	silver	800,000	5.00	300,000	9,040,000	Aug. 1, 1918	0.02½
Con. M. & S., British Columbia	l.c.z.s.g.	419,098	25.00	1,309,677	5,256,040	Jan. 2, 1919	0.62½
Granby Con. M. S. & P. B. C.	c.g.s.	150,004	100.00	1,499,848	10,573,857	Nov. 1, 1918	2.50
Hedley, British Columbia	gold	120,000	10.00	90,000	2,412,000	Dec. 31, 1918	0.15
Hollinger, Ontario	gold	4,920,000	5.00	1,230,000	9,264,000	Dec. 30, 1918	0.05
Howe Sound, British Columbia	copper	1,984,150	1.00	198,414	198,414	Oct. 15, 1918	0.05
International Nickel, Ontario	n.c. com.	1,673,384	25.00	3,346,768	.....	June 1, 1918	1.00
Kerr Lake, Ontario	silver	600,000	5.00	600,000	8,010,000	Dec. 16, 1918	0.25
Lake Shore, Ontario	gold	2,000,000	1.00	50,000	50,000	Dec. 10, 1918	0.02½
McKinley-Darragh, Ontario	silver	2,247,692	1.00	337,152	5,402,023	Jan. 1, 1919	0.03
McIntyre, Ontario	gold	3,610,283	1.00	541,542	1,083,084	Nov. 30, 1918	0.05
Mining Corp., Ontario	silver	1,660,050	5.00	1,452,544	5,906,097	Dec. 14, 1918	0.18¾
Nipissing, Ontario	silver	1,200,000	5.00	1,800,000	19,230,000	Jan. 20, 1918	0.50
Standard, British Columbia	l.z.s.	2,000,000	1.00	.....	2,700,000	Oct. 15, 1917	0.05
Temiskaming, Ontario	silver	2,500,000	1.00	75,000	2,125,000	Jan. 18, 1918	0.03
Tough-Oakes, Ontario	gold	531,500	5.00	.....	398,625	Jan. 15, 1917	0.12½

Abbreviations: g = gold, s = silver, c = copper, l = lead, z = zinc.

Note: Companies not included in the above list are requested to submit details. Changes in capitalization and new dividends will be entered on receipt of the information. This table will be published quarterly.

Company Reports

MOUNT LYELL MINING & RAILWAY CO.

Property: mines, railroads, and smelters at Queenstown, Tasmania; a group of mines near Zeehan, Tasmania; acid and super-phosphate works near Melbourne and Fremantle, Australia.

Operating Officials: Robert C. Sticht, general manager; Basil Sawyer, local superintendent; R. M. Murray, engineer in charge of mines; R. P. Roberts, chief metallurgist; G. W. Wright, chief mechanical engineer; E. C. Driffield, engineer for railways; and H. J. Clarke, engineer for supplies.

Financial Statement: during the year ended September 30, 1918, sales of copper, pyrite, chemical works profit, and railroad traffic realized £916,086 ($4,396,800). The operating profit was £455,899 ($2,189,000); less office expenses, depreciation (£50,397), taxes (£64,403), new plant, etc., leaving a balance of £247,229 ($1,185,000). After paying dividends the balance forward was £274,432 ($1,315,000), including £236,697 ($1,137,000) from 1917.

Dividends: two (No. 24 and 25) absorbed £209,494 ($1,005,000).

Development: in the Mt. Lyell mine some drilling was done, proving the downward continuation of the South Lyell orebody. Results in the North Lyell were generally satisfactory. The Lyell Comstock sent 15,607 tons to the flotation plant. Ore-reserves are as under:

Mine	Tons	Copper, %	Silver, oz.	Gold, oz.
Mount and South Lyell	2,028,747	0.49	1.48	0.040
North Lyell	1,036,300	6.00	1.33	0.005

Production: the smelter reduced 240,947 tons of ores, yielding 13,031,520 lb. of copper, 320,344 oz. of silver, and 7042 oz. of gold. The flotation plant dressed 29,703 tons of 2.95% ore, giving 88.06% recovery. Concentrate was sintered for smelting. All costs were $7 per ton of ore, a rise of 62 cents.

BROKEN HILL PROPRIETARY CO., LTD.

During the half-year ended May 31, 1918, the report being just to hand, this Australian company made a profit of £372,310 ($1,785,000). Two dividends—No. 180 and 181—absorbed £118,100 ($566,000). Excess of assets over liabilities totals £845,546 ($4,060,000).

The dressing mills at Broken Hill handled 70,843 tons of ore, 117,133 tons of old tailing, 144,944 tons of zinc tailing, and 73,991 tons of slime. The approximate metal output was 13,500 tons of lead, 9600 tons of zinc, and 1,050,000 oz. of silver. Sulphuric acid made amounted to 4254 tons.

The Iron Knob quarry produced 164,780 tons of iron ore, which was sent to the Newcastle works. These made 67,803 tons of pig-iron, 89,011 tons of steel ingots, 47,380 tons of rails, plates, etc., and 74,025 tons of coke.

AMALGAMATED ZINC (DE BAVAY'S), LTD.

Property: flotation works at Broken Hill, Australia, treating tailing purchased from adjacent mines.

Operating Officials: David Meredith, general manager; A. J. F. de Bavay, consulting chemist.

Financial Statement: revenue for the half-year ended June 30, 1918, totaled £417,155 ($2,002,000). The profit was £101,668 ($489,600). The surplus of liquid assets amounted to £151,055 ($724,800).

Dividends: three of £25,000 each totaled $360,000.

Works Operation: the plant dressed 164,719 tons of tailing, yielded 47,184 tons of concentrate assaying 48.2% zinc, 6.4% lead, and 9.1 oz. silver; and 1834 tons containing 53.2% lead, 12.5% zinc, and 65.9 oz. silver per ton. The plant treated just 1000 tons daily.

Eleven mines in the Far East Rand contribute 60% of the profits of the Witwatersrand, compared with 40% from thirty-eight in the remainder of the goldfield.

	Far East Rand	Others
Gold per ton	$8.80	$6.02
Cost per ton	4.90	5.12
Profit	3.90	0.90

INFORMATION FURNISHED BY MANUFACTURERS

RECENT DEVELOPMENTS IN FINE GRINDING

About ten years ago users of pulverizing machinery became interested in several high-speed grinders that were claimed to be more efficient as finishers than flint-pebble tube-mills then in general and satisfactory use for that purpose. While it is generally admitted that flint-pebble tube-mills as then built are superior, as fine grinders, to any high-speed machines then and now obtainable, the small wear-resisting metallic-grinding medium 'ball-pebs' since introduced has so greatly increased its efficiency that it stands today without a rival as a fine grinder for cement and other abrasive substances.

To obtain in full measure the advantage of this great improvement required carrying the grinding charge as heretofore, at about the centre of the mill. This increased the weight of charge 2½ times. Allis-Chalmers engineers, quick to recognize the importance of this great improvement, were the first to develop and manufacture the 'ball-peb mill', with parts adequately designed to take full advantage of this great step in advance in grinding practice. This still left the problem of adapting existing mills to the use of ball-pebs. Some of the methods tried were as follows: (1) Many operators simply substituted for the flint pebbles an amount of ball-pebs that would not over-strain the mill or its driving connections. In time, as a further improvement, ribbed liners were substituted for silex or smooth iron liners previously used with flint pebbles. This method, though not obtaining maximum results, gives better efficiency than flint pebbles. (2) In some cases mills were reconstructed to carry the heavier loads. While this is satisfactory in operation, the first cost is necessarily high. (3) Another alternative is to reduce the inside diameter of mill to such size that when charged to the centre the mill and its driving connection are not over-strained. The principal objection to this method is the recognized lesser efficiency of smaller diameter mills. (4) Another alternative is the use of division heads to blank the centre of mill and carry the ball-pebs to near the centre in two ends. This method also gives satisfactory results, but necessarily introduces additional wear on the two division heads.

Until recently small spheres, cylinders, nut and boiler punchings, have been the most common forms of metallic grinding bodies. Efforts have been made to improve on these by studying and experimenting with special shapes. Laboratory experiments showed that boiler punchings of much greater diameter than thickness ground more efficiently than spheres of ordinary cylinders from feed 75% through 200-mesh to discharge 80% through 200-mesh; but, for grinding from minus 20 or minus 30-mesh, spheres, because of their greater weight, rolling and pounding action, were more efficient than cylinders or boiler punchings that have principally a sliding action. The first experiment showed the necessity of area of contact and the latter that for customary grinding, rolling and pounding is necessary to reduce the larger particles.

An entirely new product, the 'Concavex', resulted from the effort to combine in one body these two essential features. As its name implies, it has both concave and convex surfaces, the preferred shape of manufacture being a sphere with two sides cupped, forming concave surfaces with radius about the same as the sphere. Concavex are made in various diameters, size of feed and desired fineness of product determining the diameter to be used. In cement-mill practice the 1¼-in. concavex are the best substitute for the ¾-in. ball-pebs. The large contact area, due to their shape, gives them great efficiency. Their peculiar shape tends to eliminate shrinkage strains, thus permitting the use of much harder mixture without sacrificing strength. Of greatest importance to users of flint-pebble tube-mills, is that with concavex the expensive reconstruction necessary to use metallic grinding bodies efficiently in such mills is eliminated. On account of their interlocking shape their angle of repose is greater; consequently, a low charge is carried higher in the mill, and therefore attains the rolling action found in mills charged to the centre-line, and without over-straining the mill or its driving connections, thus offering a means heretofore unavailable to convert such mills to efficient grinders at reasonable first cost.

ELECTRIC HOISTS IN THE SERVICE

By James Monroe

During the War, the machine-shop manager had to depend greatly upon mechanical means for increasing his output. With long deliveries on machine-tools, their purchase meant no immediate relief. He had to cut down the time spent in handling raw material and finished product through the shop. There are three distinct phases to this problem: (1) Unloading raw material from cars; (2) carrying material and parts through the shop between operations; and (3) loading the finished product on the cars.

A satisfactory and efficient method of shortening these

Fig. 1

operations, and also reducing their cost is the application of the electric hoist made by the Link-Belt Co. of Chicago.

Fig. 1 shows one of these machines unloading pipe from a gondola car. This class of material, and plates and shapes as well, may thus be handled with the greatest ease.

Hoists simplify the handling problems throughout a plant i many ways. Motor-trucks were of immense importance in all departments of the Army. One of the overhead cage-

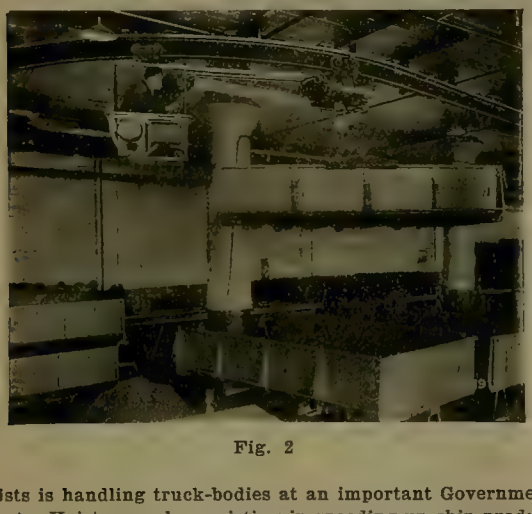


Fig. 2

hoists is handling truck-bodies at an important Government plant. Hoists are also assisting in speeding-up ship production, and in the Navy yards.

With the great scarcity of cars, and high demurrage rates, quick loading has been vital. For loading gondolas, the load may be brought directly over the car, and then lowered. A well-known manufacturer of Government truck-bodies has seen in the mono-rail hoist system an ideal method. Fig. 2 shows the runway. The operator has just lifted a body from the storage-pile, and is ready to carry it out over the car. This track system is in the shape of the letter U. The curved part covers the storage area, while the two straight sections run over two parallel sidings. This is an important link in the production system.

The electric hoist did not need the War to bring it into the public eye, but its scope has broadened, and it has shown some of the war industries how to operate intensively and efficiently.

COMMERCIAL PARAGRAPHS

The Chicago Pneumatic Tool Co. announces the appointment of L. C. Sprague as assistant secretary with headquarters at 52 Vanderbilt avenue, New York.

The Meyer dry-ore concentrator, made by the National Milling & Refining Co. of Canton, Ohio, is described in a bulletin recently issued. This machine was fully discussed in the 'Press' of May 4, 1918.

The W. A. Zelnicker Supply Co. of St. Louis announces the appointment of Joseph Meyerson as secretary to the president. He was associated for 10 years with the Southwestern Tariff Bureau.——Mr. Kottsieper has recently joined the traveling force of this firm and will make the South-Western territory.

The Milliken Brothers Mfg. Co., Inc., Woolworth building, New York, has just published a new illustrated book, entitled 'Space and Speed in Steel Buildings', giving a description of the standardized truss-unit system of building construction, designed and manufactured by the company. This system of erection is suitable for all classes of industrial and manufacturing buildings, making use of a simple common structural-steel unit both for columns and trusses. No plans are necessary, and the buildings are either permanent or portable. The system makes possible low transportation and erection costs. The book shows a number of interesting halftones, illustrating different buildings of this type constructed for the United States government. Copies may be obtained free from the company by those interested.

On page 16 of the advertisements in the 'Press' of December 7 the **General Engineering Co.** of Salt Lake City stated that the Callow pneumatic flotation plant was "now making a 98% recovery (by the month) in the form of an 80% MoS_2 product at the Dominion Molybdenite Co.'s mill, at Quyon, Quebec." The firm writes us that it was in error, and the note should have read "a 95% recovery in the form of a 93% MoS_2 product."

The American Zinc, Lead & Smelting Co. of St. Louis, Mo., has published a 35-page booklet on its 'Azo' zinc oxides. The information is useful for paint and varnish manufacturers. After experimenting for two years the company entered this field late in 1917. The products are made at Hillsboro, Illinois. They show highly desirable qualities by analysis, and only contain from a trace to 0.02% sulphur di-oxide and 0.2 to 0.5% zinc sulphate, both undesirables.

Price-list No. 18 for **du Pont black blasting powder** has been issued. The prices were effective December 13, 1918, and f.o.b. Pacific Coast points. In carload lots (800 kegs) the price is $1.90 per keg, for 100-keg lots $2.20, for 10-keg lots $2.30, and less than 10-keg lots $2.45 each. In the high-explosives list, effective same date, the strengths from 20 to 60% are given as so much per carload, ton, or less than ton. The San Francisco office is at the Chronicle building.

Since H. W. Hardinge of the **Hardinge Conical Mill Co.** acquired a considerable interest in the **Denver Engineering Works,** some important changes have been made relative to district offices: R. B. T. Kiliani, secretary-treasurer of the Hardinge company, has been elected vice-president and treasurer of the Denver Engineering Works, and is a director of that company. His office will be at First National Bank Bdg., Denver. V. A. Stout, sales engineer, has removed his office from San Francisco to Salt Lake City. With him will be W. L. Penick, formerly with the Granby Consolidated M. & S. Co. at Anyox, B. C. Mr. Penick has been acting as sales engineer for the Hardinge company for several months. Some changes in the organization of the Denver Engineering Works Co. have been made within the last two or three months: Lewis Searing has resigned as vice-president to go East. His position has been filled by W. W. Torrence, formerly with the General Electric Co. at Denver. Alfred Tellman, formerly metallurgical engineer and superintendent at the plant of the Ridder Mining Co. in Siberia is in charge of the engineering work connected with the sale of milling equipment. Mr. Kiliani of the Hardinge company will handle all the sales business for the Denver Engineering Works in so far as it relates to milling equipment.

When two contiguous groups of mining claims are owned in part by the same people, but also having other owners of one group who are not owners in the other, it is unsafe to perform assessment work for all claims of the two groups by means of group work done on one group alone. The difficulty can be remedied easily, however, by a joint agreement between the owners of both groups providing that the assessment work done on one group shall be for their common benefit. This year of course the claimants can file with the County Recorder notice of their desire to take advantage of the Act of Congress providing for the exemption of claims from assessment work during the year 1918.